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J. M. WAKEMAN, - - - - - - - - President and General Manager.

CHICAGO OFFICE, - - - - - - - - - - - - 936 Monadnock Block.
PHILADELPHIA OFFICE, - - - - - - - - - - 929 Chestnut Street.

EUROPEAN OFFICE, - - - - - - - - - - A. C. Shaw, Manager.
Hastings House, Norfolk St., Strand, London, England.
PARIS, - - - - - - - - - Electricity Building, Paris Exposition.

T. C. MARTIN AND W. D. WEAVER, - - - - - - - - - - - Editors.
T. R. TALTAVALL, - - - - - - - - - - - - Associate Editor.
CARL HERING, - - - - - - - - - - - - - - Special Contributor.

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THE EDISON CONVENTION

In spite of the fact that certain conditions have set limits to its growth, the Edison Association of Illuminating Companies continues a career of good and useful work. The benefits of its proceedings are confined chiefly to its own members, as it has no belief in the virtues of the "open door"; but its transactions are printed, and the results of its deliberations by slow filtering become part of central station daily practice. Hence, in the long run, the policy of excluding the public from its meetings entirely is not so harmful or so selfish as might at first thought appear. On the contrary, it may be regarded as a piece of abnegation and self-sacrifice, for no man exactly relishes the task of preparing a good paper to have it put out of sight immediately; and we have understood that the association in reality suffers a little on this score. Seen from the standpoint of the journalist, this willingness of the association to blush unseen has much to commend it, as it relieves him and his pages from the pressure of just that much more "matter." At this season of the year, usually for some six weeks, conventions are in progress at the rate it would seem of almost one per day, and during the present year there have been added the International Physical and Electrical Congresses at Paris, with literally thousands in attendance and hundreds of papers presented. The editor's duty is reduced for a time largely to the work of registration, but is none the easier in view of the mass of material through which he has to wade. When, therefore, he encounters an example of reticence and reserve like that of the Edison convention, one emotion is that of thankfulness.

The excellent presidential address of Mr. Lieb, who has been worthily re-elected, together with the outlined programme, gives a good idea of the questions pressing upon this group of central station companies for treatment. They are in general just the same as those which other stations have to solve, and each year brings up some new point, or some old issue in a new form. That these Edison stations are radically changing their practice, while remaining true to all the old ideals, is shown by the fact that the discourse of Mr. Steinmetz on alternating current work, supplemented by papers dealing specifically with alternating current problems, constituted the most important feature of the convention.

THE LIBERTY STATUE.

One of the New York newspapers has a pithy and timely article on the state of dilapidation and ruin into which the Bartholdi Statue of Liberty in New York Harbor has been allowed to fall. So far as our own observation goes, the criticism is well founded, and the present condition of the stately monument is a sad reflection on our gratitude towards the generous French people for their noble gift.

The whole trouble arises, it seems to us, from having put the statue into the hands of the Lighthouse Board, on the supposition that it is a beacon. It is nothing of the kind, and we should say that no beacon is needed there, of such a character. The paltry lighting now done in the torch could be extinguished without any injury to anybody. But just as the figure stands up against the sky by day, so at night it could be made equally beautiful by having the beams of searchlights projected on it from the angles of the old fortification within which it stands. It would then be softly visible after dark for miles, and there would be no blinding glare to annoy the mariner.

But to have a 150-foot statue enlightening the world electrically with a 100-cp lamp is preposterous. Perhaps it is not fair to expect the sense of humor to be highly developed in lighthouse boards. Perhaps the blame for a discreditable state of affairs lies in part with the War Department, which exercises also some authority over the island.

A GREAT STREET RAILWAY SYSTEM.

The annual report of the Metropolitan Street Railway Company bears emphatic testimony to the service rendered by that corporation to the city of New York under the régime of electricity. Over its 217 miles of road it carried, for the year ending June, 1900, enough passengers to earn the gross enormous sum of $14,721,550, and operating at a percentage of 48.26, it had a net of $7,104,607. With the same mileage as in the preceding year, it made a gain of $1,562,920 in the gross and $695,896 in the net. These are eloquent statistics as to the appreciation shown by the community of a good system, for in the last year reported the company carried 382,000,000 passengers, including 128,000,000 transfers, and its traffic is still growing rapidly, while it has now, as a quite logical move, gathered in the Third Avenue system, thus rounding out its network.

At the present moment the company is straining every nerve in a creditable anxiety to complete rapidly its change from cable and horse to electricity. When the cable was put in some years ago on Broadway, we ventured to remark that it was a pity not to take the full jump in mechanical operation and adopt an electric conduit system. The cable has done such good work in the meantime, the change comes sooner than we expected; but an administration with the vigor and ability of Mr. Vreeland's must necessarily push onward swiftly in every plan of improvement.

IN THE MATTER OF AUTOMOBILISM.

As a fine example of fruitless competition commend us to the automobile races perpetrated near Newport last week. It was like a horse race open to all, without reference to record, gait or weight, and ended in a general scramble in which the machine with the biggest motor came out ahead. In this sort of competition the electric vehicle made a showing which under the circumstances was most creditable. But in the name of common sense and public safety we must protest against such indiscriminate scorching matches. The automobile is here and here to stay, but it should be saved from the hands of some of its friends, else the city fathers and the country grandfathers may take such steps as will render automobilism anything but an agreeable pastime.

Developing a speed of a mile per minute huddled up behind green goggles on a gasoline tank may be sport after the Gallic canons, but it will not go far or fast toward encouraging the general use of automobiles for practical purposes. The road races of the early summer were much more to the point, for they brought out machines capable of fairly hard service and ample speed for ordinary uses. The faults of automobiles at the present time lie not in the matter of speed, but in weight, noise, smell, short radius of action and general complication. For pleasure riding a machine that can make fifteen miles an hour if necessary, or run forty or fifty miles without attention and with the reasonable certainty of getting home, is far more useful than a racer which may make forty miles in an hour, or be left on the road and sent home by freight.

Simple mechanism, easy operation and solid construction are necessary before automobiles will be trusted and used by the general public. It is by no means certain that any one form of motive power will drive out the others, for each has its advantages and its grave drawbacks. Steam is attractive from its reliability in operation, until the mechanism goes wrong; gasoline explosion engines are very simple and smelly, except as regards the speed changing gear; and electric carriages are ideal until the battery gives out—and the nearest charging station a dozen miles away. To be brief, the real test of an automobile is its ability to run moderate distances at moderate speeds day after day, and week after week, with small repairs and renewals and without expert care. Gains in speed are far less important than gains in convenience and reliability. And these are things which no sort of racing can attest, particularly the kind anent which this sermon is preached.

CONSECRATING AN ELECTRIC RAILWAY.

The Sodus Bay Electric Railway, which runs from Rochester, N. Y., to Sodus, on Lake Ontario, was publicly inaugurated a few days ago with unique ceremony. The completion of this road was accomplished after various delays and setbacks, and, in order to give expression to their exuberant joy at having won a victory over all the obstacles interposed by nature and man, the promoters of the enterprise deemed the occasion a fitting one for an extraordinary demonstration. They, therefore, to that end, invoked the occult powers of the Order of the Mystic Shrine, 500 members of which conducted the exercises. After surrounding the first car, the chief prophet uttered these mysterious words: "In the name of Allah and Mohammed, his prophet, I do now christen you Sodus Bay Railway, Margaretta. No harm or accident shall come to any one connected therewith. Aug. 22, 1900."

If the words of the prophet are to be taken literally, the Sodus Bay Railway stands unique among railways in its immunity from the machinations of evil spirits. On the other hand, if the asseveration is to be taken in a Pickwickian sense, the Sodus Bay Railway will be just as safe as the good sense of its managers and employes make it. In any event, no harm should come to the railway or those connected with it from the drenching of champagne received by the first car over the road. A good time was no doubt the essential purpose of the pilgrimage.

ELECTRIC FURNACES.

A paper read by Mr. Keller before the Paris Electrical Congress gives a good, general classification of electric furnaces employed up to the present time. Three classes are described, namely, arc furnaces, resistance furnaces and incandescent furnaces. In arc furnaces there are several structural sub-divisions, but the heat generated in a voltaic arc is supplied to the substance acted upon. In resistance furnaces, there is no localized arc, and the heat is joulean, developed in imperfectly conducting material acted upon directly. The third class differs from the second only in the fact that the material to be acted upon is not initially conductive, and a conducting layer has to be provided between the electrodes to start the process. Various other classifications are, however, possible. A very obvious division exists between furnaces in which electrolysis is effected—electrolytic furnaces—and those in which thermal effects only are employed—electrothermic furnaces. The former belong to the direct-current type; while the latter may employ alternating currents.

Although the origin of electric furnaces is by no means recent, it has only been of late that large electric furnaces have been used. They now employ, singly, currents up to 10 kilo-amperes and absorb powers up to 1000 kilowatts, while the temperature attained within them is said to be in excess of 3000 degs. C., or

the highest yet attainable artificially. It seems reasonable, moreover, that it will be possible in the future to develop and attain in electric furnaces temperatures yet higher. There can be, in the nature of things, no theoretical limit to temperature in the ascending scale. It would seem that a body must always get hotter if heat is added to it faster than it is abstracted. Practically, of course, there is always a limit, but the limit of to-day is not necessarily the limit of the next decade, and depends among other things upon experimental skill. On the other hand, it seems that there may be an inferior limit to temperature, and 273 degrees below the temperature of melting ice is the supposed absolute zero. Assuming that this is correct, we may say that, although there may be but limited room in the temperature scale below that at which protoplasm flourishes and life abides, yet there is always room at the top, and thermometer scales in a certain sense are like directions in space, they go on indefinitely.

THE JOINT INSTITUTE DISCUSSION IN PARIS.

The topic for discussion at the joint meeting in Paris was left to our British confrères to formulate and propose. Such a task is by no means so easy as it first appears. There are hundreds of topics which would awaken interest in some coterie of electrical engineers on one or other side of the Atlantic, but only a very few would awaken general interest on both sides. A topic suitable to such an occasion must be devoid of personality, and must not arouse sectional feeling. All this was no doubt clearly apprehended by the Council of the British Institution. Their choice was finally made, it will be remembered, upon "The Relative Advantages of Alternate and Continuous Currents for a General Supply of Electricity, Especially with Regard to Interference with other Interests." This selection was felt to be a happy one, except that there was a difficulty in understanding what it meant. The relative advantages of direct and alternating currents needed no elucidation, and was quite capable of occupying a whole day in discussion. The uncertainty arose as to what the "other interests" were, and how they could be interfered with. It even seemed to a few of our American friends not in the secret, that as much interest would attach to the discovery of what was meant by the title, as to the nature of the opinions elicited.

All mystery was, however, cleared away as soon as the discussion was opened, for the proposer indicated that the interests involved were those of gas and water supplies, whose pipes might be electrolytically affected by the electrical distribution, and also magnetic observatories or telegraph stations, whose instrumental records might be vitiated. The topic, therefore, virtually centered upon the question whether in view of electrolytic and magnetic troubles incident to direct-current distribution, it was not preferable to keep strictly to alternating currents under all circumstances. This introduced the consideration of electric railways and of storage batteries. In Europe there are a few electric railways operating successfully with alternating currents. In America all electric railroads at present in commercial use may be said to employ the direct-current system.

It was pointed out in the discussion that in long-distance power transmission alternating currents are always employed, and that the supply of direct-current railroad systems involved the use of the converter, at considerable trouble and expense. On the other hand, if alternating-current street-railway motors could be successfully standardized, the use of the storage battery for reducing local investment and maintaining uniformity of pressure would have to be given up.

Opinions varied concerning the dangers from electrolysis. Some favored the double trolley, thus avoiding the ground-return circuit. Others considered that with adequate rail-bonding and a reasonable expenditure in copper return feeders, the dangers of electrolysis could be practically annulled. The disadvantages of the double-trolley wires when overhead are, of course, the greater proximity of the opposite conductors with liability to crosses, and the reduplication of overhead network. As representing the merits of direct-current systems, it was pointed out that alternating currents were quite capable of producing the electrolytic corrosion of buried iron under certain conditions, and that widespread distribution of alternating currents was calculated to cause much inductive disturbance in telephonic or telegraphic circuits.

Although the time which could be given to the debate was rather short, the discussion was successful in crystallizing the arguments on both sides of the question. The success of the meeting leads to the belief that in future any matter of importance pending before an international electrical congress should be brought up for discussion in a similar general gathering of the electrical fraternity in order to arrive at the consensus of opinion which a congress would have neither the time nor the opportunity to elicit.

HIGH POTENTIAL WIRES.

In commenting recently on the action of the underwriters with respect to grounding low potential circuits, we held for deliberate consideration a brief paragraph in the same report bearing upon high tension circuits. Its character is such, however, that it deserves serious and most condemnatory mention. In effect, the position is taken that the underwriters not only regard voltages over 3500 as extra high potential and requiring special precautions, but that they propose to bring pressure to bear on municipal and town authorities to induce them to forbid the installation of such circuits. As to the first count it is probably necessary to make some distinction between pressures of 1000 and 10,000 volts, and drawing the line at 3500 volts may serve a temporary purpose. The proposal to enter upon a course of instruction of city governments in the alleged dangers of high voltage, is quite another matter, and unless the threat was made unadvisedly, it must be considered as an open declaration of war by the underwriters upon modern methods of electrical distribution.

It seems hardly possible that so inflammatory a course could have the indorsement of a committee in other respects so judicious, but on reflection they must become well aware that the proposed step is a very serious one, which will unite the entire electric lighting and power industry squarely against them. The statement that voltages such as are used, for instance, on transmission lines, measurably increase the fire risk, will not stand the test of investigation. Considering the extra care that is taken, necessarily, in insulation, a 10,000-volt transmission circuit is practically far less dangerous than the average arc light circuit of 2000 to 3500 volts. The former must, for its own sake, be well installed and kept clear of obstructions, while the latter has to run in situations that make insulation too often a hollow farce. If the underwriters would start a campaign of education for the improvement of interior wiring, we should bid them god-speed, but the present suggestion is most objectionable. The whole body of the electrical profession will stand by the underwriters in any honest effort to improve the state of the art, and this sort of attack is simply incomprehensible. We cannot but believe that the committee has either acted somewhat thoughtlessly in the matter, or has been grievously misled as to the facts by irresponsible and disingenuous alarmists. It is unpleasantly suggestive of the kind of reports on the cause of fires often brought in a few years ago: "This fire was unquestionably due to electric wires, although the flames removed all evidence of the origin." At all events, we cannot let the matter pass without notice, for the course of action suggested would be *casus belli* with a vengeance.

A Destructive Storm at Galveston, Texas.

On Saturday, Sept. 8, the city of Galveston, Texas, was visited by a terrific storm which killed 1000 people, on the lowest estimates, and destroyed property to the value of $12,000,000. These figures do not include the loss of life and property in the region around the city. Up to the present time of writing, it has been difficult to obtain detailed information, owing to the fact that every telegraph and telephone line on the island occupied in the Gulf of Mexico by the city was prostrated, so that during the first days of this week thousands of telegrams accumulated at both ends of the Western Union and Pistal circuits. The waters of the Gulf swept over the low-lying city to a depth of ten or twelve feet, carrying devastation everywhere and leaving a slimy mud an inch deep over everything. By last reports both the electric lighting and street railway plants have been destroyed, or so badly damaged as to be put out of service. It is also stated that as far away as Houston, Texas, fifty miles distant, damage to the extent of $60,000 was done to the electric light plant. So far, no loss of life in these systems is known, but word has been received that chief operator Johnstone, of the Postal Telegraph Company, at Galveston, has lost his entire family in the storm.

The force of the storm and its tidal wave was so great that the cables at Galveston were broken. Great efforts have been made to repair the damage to the Mexican cable, but on account of the sea running so high, it has been impossible to pick up the ends.

President Glidden, of the Erie Telephone system, has received telegrams from the managers of the Texas divisions as regards the damage caused by the West Indian hurricane. The principal damage was confined to the cities of Houston and Galveston and the lines between. A force of 500 linemen has been concentrated at Houston and the work of restoring the telephone system will progress rapidly. There are 1931 subscribers at Houston and 1982 subscribers at Galveston. The company operates 40 wires between the two cities. Most of the wires at Houston are underground and the damage is slight, but on account of conditions of the soil the system at Galveston is aerial cable. About ten miles of the long-distance lines between the two cities have been wrecked and many of the cables at Galveston are blown down, but otherwise uninjured. President Glidden, from advices received, places the Erie Company's loss at $50,000.

The following despatch was received on Monday at the New York general offices of the Postal Telegraph & Cable Company, in this city, from General Superintendent English, of that company, at Houston, Texas: Three of our operators just arrived at Houston from Galveston. Chief operator lost his whole family and is badly bruised. Reported that our manager and his family are saved. There is not a telegraph pole standing on the island. The telegraph line of the Gulf & Inter-State Railroad completely washed away for fifteen miles. Bodies rotting in the street. Hauling them out to sea. Cannot get men to bury them. Telegraph lines completely wrecked. Newspaper reports not exaggerated.

Manager A. E. Sink, of the Western Union Telegraph Company, stated on the same day that he had received word from the Galveston district to the effect that the house of J. C. Smith, the manager of the Western Union office at Galveston, had been destroyed, but that Mr. Smith had managed to save the lives of his wife and child. Several other servants of the company had lost their families.

Electric Lighting in Porto Rico.

Some very curious and interesting developments have lately been witnessed in the Island of Porto Rico in connection with the introduction of a new electric lighting and trolley system. It appears that some enterprising Americans have organized the San Juan Light & Transit Company, and started out to give the inhabitants of that city an up-to-date service in both departments, there being only an old-fashioned direct-current lighting service now and no electric railway—only some ramshackle steam cars. The new trolley system, about nine miles in length, will operate at 500 volts direct current, but the company in offering to take a five-years' contract for street arc lighting, has proposed to adopt an ordinary 2200-volt alternating-current system. This, it would seem, has been made by the owners of the old direct-current service, the occasion for an extraordinarily vicious onslaught upon the alternating current, on sensational newspaper lines, through the medium of the San Juan *News*. That journal claims to have cabled to the New York *Sun* a statement of the facts in the case, and to have obtained through that source statements from the two "world's greatest electrical experts," the editors of two weekly electrical journals published in New York City. The despatch alleged to have been sent by the *Sun* mentions the names of these two distinguished authorities, and goes on to say that they "declared that the installation of the alternating-current high-tension system of lighting in San Juan would be little less than a crime. Mr. —— pointed out that the high-tension system would at first be cheaper, but eventualy much dearer, the low tension being better in every way. The high-tension system is most dangerous where wires are strung on housetops, and is almost criminal; especially would this be the case in San Juan, where people unacquainted with the dangers are constantly on the roofs. The first week of the alternating-current high-tension system would mean death to many." The other authority cited held that in San Juan, a city of barely 30,000 people, the wires must be placed underground, "otherwise they would work havoc to life and property"—the experience of this country, which is full of aerial alternating circuits, to the contrary notwithstanding.

Nor was this all. This marvelous despatch of dubious origin was supplemented by an alleged interview in which one of the electrical editors is actually credited with having said: "The electrical companies do not care about what lives may be lost through any system they may install. All they look at is what is the cheapest and easiest system to put in." The other quoted interview says that "if high-voltage wires are strung from housetop to housetop, it will virtually be murder."

It is rather late in the day to see the renewal of these obsolete attacks on the now universal alternating current, and to find the authority of the New York *Sun* and of two New York electrical editors cited in support of them, in conjunction with a wholesale defamation of electric light companies in general. An explanation is in order somewhere. In the meantime, it is to be sincerely hoped that the citizens of San Juan will not be hindered by this suspicious farrago of nonsense and prejudice from adopting the benefits which progressive American capital and the latest American electric engineering place at their disposal. The municipality of San Juan can easily find out for itself the facts as to the universal use—and safe use—in this country, of aerial alternating circuits, not only in small places but in cities much larger than their own. In fact, they need not look much further than the Caribbean itself.

Annual New York Metropolitan Report.

The annual report of the Metropolitan Street Railway Company for the year ended June 30 is as follows:

	1900.	1899.	Changes.	
Miles operated ..	217	217		
Gross	$14,721,550	$13,158,630	Inc.	$1,562,920
Op. ex....	7,104,607	6,408,711	Inc.	695,896
Per cent..	48.26	48.70	Dec.	.44
Net	$7,616,943	$6,749,919	Inc.	$867,024
Fixed charges....	4,608,768	4,477,757	Inc.	131,011
Balance	$3,008,175	$2,272,162	Inc.	$736,013
Other inc....	351,985	366,893	Dec.	14,908
Total inc..	$3,360,160	$2,639,055	Inc.	$721,105
Div. paid	3,145,891	2,471,675	Inc.	674,216
Surplus	$214,269	$167,380	Inc.	$46,889

The comparisons in the above tables are on identical track mileage for both years, and exclusive of the lately-acquired Third Avenue system, which comprises 209 miles in actual service and between 35 and 40 miles of undeveloped franchises in that portion of the city lying beyond the Harlem River.

During the fiscal year of 1899 the capital of the company was increased from $30,000,000 to $45,000,000, which accounts for the increase of $674,216 in dividends paid.

The miles of track operated in 1899 and 1900 were the same, but while horse and electric power was used on the Amsterdam Avenue line during part of 1899 only electric power was used in 1900. This accounts in a measure for the decrease in the operating expenses. The average cost of operation per mile by electric power is 13 cents, whereas by horse power it is 19.43 cents.

How Can Central Stations Earn Larger Revenues?—III.

(Concluded.)

BY ALBERT B. HERRICK.

IN the two previons sections of this article we have considered exhaust steam heating and pumping water as means of increasing central station income. We come now to the discussion of refrigeration and a few other less important subjects of the same nature.

In mechanical refrigeration there is presented to the central station manager a method of turning considerable power into a salable article, with a cheap raw material, and not a large labor item. In fact, in the manufacture of ice, station labor can be utilized which is

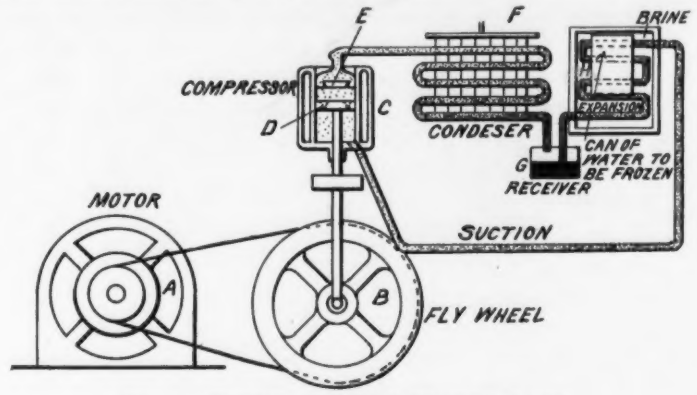


FIG. 4.—PRINCIPLES OF REFRIGERATING PLANT.

now only partly employed. Ice, also, is a product for which there is a ready demand; it has not the objection of necessitating a franchise and large capitalization for plant covering considerable territory; it uses power at such times as it can be delivered economically from the station, and the maximum power is required during the summer when the station load factor is at a minimum, and the minimum demand is on when the station is at a maximum. To sum up, ice production seems to be a natural adjunct to a small station with surplus ability to produce power.

As facts regarding the manufacture of artificial ice are not much known among central station managers, the details of its production will be gone into more fully, explaining only those systems which have been accepted by refrigerating engineers as commercially successful. Ammonia gas being compressed and cooled produces on expanding again the freezing agent used in most of the plants. Fig. 4 gives the elementary principles by which the refrigerating plant is produced. The power from a motor, *A*, is applied to a compressor through the flywheel, *B*; this operates the ammonia compressor, *C*, which may be double or single acting—single is shown for simplicity. The gas enters through the valve, *D*, on the downward stroke of the piston, and is compressed in this cylinder chamber above the piston, and through the valve, *E*, to remove the heat of compression. The gas is then passed through the cooling coil, *F*, or condenser, where the gas is condensed into liquid form and heat taken out of it by condensing water; thence it passes in liquid form to the receiver, *G*, and is from there expanded in a cooler or brine tank, *H*, reducing the temperature of the brine by as many negative heat units as have been cooled by the condenser. After passing through the expansion coil it passes back to the compressor, and the cycle is completed.

Two systems are employed in the manufacture of ice. One is to put the water in cans, which are surrounded by the cold brine that freezes the water in the cans. The other method is to pump this cold brine through a cell having iron walls and surrounded by water; the ice is frozen against these plate surfaces. The brine is kept in continuous circulation through these cells, then through the cooling coil and back again by means of a pump. These plates are sometimes as large at 10 ft. x 20 ft., and are frozen 12 ins. thick and weigh over 5 tons each.

Whether can ice or plate ice should be manufactured, depends upon the following conditions: If the station is large with considerable surplus power and serving a number of retail customers, the can plant would be the most feasible, as the amount of ice manufactured can be readily varied according to the demand. The first installation of the plant is cheaper, and does not require as much ground space. But in small plants which have not the ability to supply a large daily output, the plate plant offers the advantages of being able to store this ice without cooling the storage rooms more than by good insulation, and during the winter season ice can be manufactured cheaply and stored, which can be sold during the summer months, bringing a maximum price which should increase the total revenue from the plant.

The water required for freezing can be obtained from condensed steam by using oil separators and filters which give a water freed from a large amount of air. This is necessary to make clear ice in the can system, and improves the character of the ice in the plate system. The method of treating steam and water after passing through the engines has been so perfected in the ice business that practically pure ice can be made from this condensed steam.

In order that the full compressor load shall not fall on the peak of the station load, two compressors are necessary, one large one, which is capable of freezing the ice required in 20 hours, and a small compressor which is capable of holding the temperature of the brine and advancing the freezing slightly during the peak of the load. This is not needed in freezing weather when the station load is at a maximum. The relation of the sizes of these compressors to each other and to the total output depends on the climatic conditions, the length of the peak on the station and the type of ice plant.

Fig. 5 gives the load curve of an ice plant of 50 tons daily capacity operated from the plant with the load factor already discussed. It will be seen that 140 horse-power will be required for the 20-hour compressor and 30 horse-power to hold over the peak. The all-day plant efficiency is increased materially by the addition of this character of load, so that this additional load is carried for about 2½ tons of coal per day, or at a delivered efficiency of less than two pounds of coal per hp-hour. This point is one that should be borne in mind when adding a load which can be controlled for a maximum load factor on the station—that the total station efficiency is raised so that the coal consumption will not advance nearly as fast as the load increases, due to the reaction in efficiency throughout the whole plant.

The revenue from the ice plant depends on the price which can be obtained for the product, which is largely controlled by local conditions as to shipping rates. A table has been worked out for different freezing plants showing the approximate cost of ice from the different methods employed in its manufacture, comparing an independent steam-driven plant with an electrically-driven plant and a plant operated conjointly with the station. The elements, coal, oil, ammonia

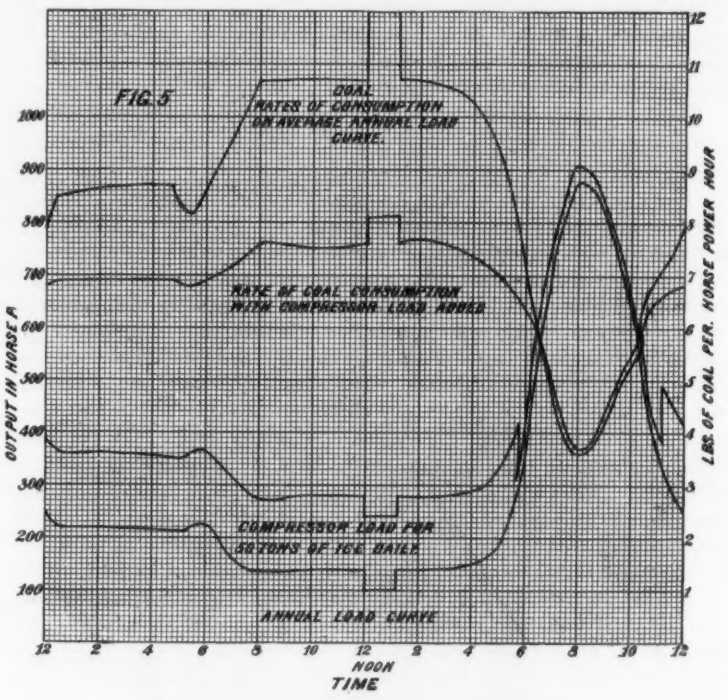


FIG. 5
COAL RATES OF CONSUMPTION ON AVERAGE ANNUAL LOAD CURVE.
RATE OF COAL CONSUMPTION WITH COMPRESSOR LOAD ADDED
COMPRESSOR LOAD FOR 50 TONS OF ICE DAILY
ANNUAL LOAD CURVE
OUTPUT IN HORSE P
LBS. OF COAL PER HORSE POWER HOUR
NOON
TIME

FIG. 5.—LOAD CURVE OF 50-TON ICE PLANT.

and miscellaneous supplies, are taken under the head of "Supplies," with coal at $3. Under the column of "Fixed Charges" come interest, insurance and executive salaries, and the cost of labor under the three methods of operating. The cost of distribution per ton has not been estimated on, as this cost may vary from 60 cents to $3 per ton, depending upon local conditions.

Taking up the 50-ton plant electrically operated, under the tabular list it will be seen that the production cost is 86 cents per ton against $1.20 per ton with the steam-driven plant. The power delivered is figured to cost so as to show 34 cents per ton difference, from which there arises a difference in profit of $4,500 between an independent steam-driven and an electrically-driven ice plant.

But in a plant conjointly operated with an electric light plant, there is an annual difference of over $7,000, which favors this class of plant so much as to discourage competition. This difference is due to the natural advantages of the combination of these two industries.

To summarize the points thus far elaborated in this article, there are elements where an auxiliary enterprise can be operated with lighting plants using their by-products or surplus power at times when it can be delivered below the cost of operating a self-contained plant. But the elements which surround an undertaking of this kind should be so thoroughly analyzed and the demand for the product guaranteed so that there will be do doubt that the auxiliary enterprise, working even under the most disadvantageous conditions, should show a satisfactory profit to encourage this investment.

TABLE ON COST OF PRODUCING ICE PER TON.

Daily Output in Tons.	STEAM DRIVEN PLANT.				ELECTRICALLY DRIVEN PLANT.				OPERATED CONJOINTLY WITH ELECTRIC PLANT.			
	Per Ton. Supplies.	Per Ton. Fixed Charges.	Per Ton. Labor.	Total.	Per Ton. Supplies.	Per Ton. Fixed Charges.	Per Ton. Labor.	Total.	Per Ton. Supplies.	Per Ton. Fixed Charges.	Per Ton. Labor.	Total.
5	$ .72	$ .65	$1.20	$2.57	$ .48	$ .55	$1.10	$2.13	$ .48	$ .55	$ .60	$1.63
10	64	56	60	1.80	42	50	50	1.42	42	50	32	1.24
20	56	48.2	46	1.50	39	42	45	1.26	39	42	30	1.11
30	53	45.6	44	1.43	31	41	40	1.12	31	41	27	.99
40	50	43.2	43	1.36	26	36	39	1.01	26	36	25	.87
50	48	32.1	40	1.20	23	28	35	.86	23	28	21	.72
75	43	27	32	1.03	21	25	28	.74	21	25	16	.62
100	37	25.5	29	.92	20	23	26	.69	20	23	14	.57
150	28	22	25	.75	19	21	23	.63	19	21	12	.52

It can be readily seen from the above applications of a supply of electricity from the station under the control of the station that many adaptations of electricity to commercial work could be made at prices for limited delivery, which, based on standard prices of current delivery, would not be encouraged.

The period for such power delivery for industrial purposes is from sunrise to sunset. With this limitation in both summer and winter seasons this industrial load is removed from the peak of the lighting load.

Electric heating of ironing and embossing devices for textile factories and laundries, forms this character of load, for the work produced by daylight is in many cases much superior to that produced by artificial light. There are a number of towns in which are located special industries, such as silk weaving in Paterson, N. J.; glove-making in Gloversville, N. Y., and shoe finishing in Lynn, Mass., and a number of other cases. Here the artisan is often deterred from working at home because he has no method of getting power which would not cut largely into his profits. If the period of his work could be restricted in reference to the station load, and special service made to this class of customer, which could be discontinued before the peak comes on the station, the cheap power furnished in this way would encourage the growth of small industrial establishments with a development of artistic, more perfect and more individual work.

The formation of chemical compounds electrically has been looked into by several stations. This was especially the case in regard to acetylene or calcium carbide, when it was first presented so as to excite the interest of the public before its true value was known. This is a very simple chemical process, the chemical combination taking place in applying the electric arc to a powder of lime and carbon, but there is still great doubt as to the sale of the product being locally sufficient to warrant the expenditure for the installation and power necessary.

The manufacture of aluminum from its oxide would have to be carried on upon a larger scale to be made profitable than the surplus power of an ordinary station would warrant, and the potential of the current would have to be lower than for ordinary station service.

The deposition of copper also presents a possible means of taking the surplus current from the station, for in depositing metallic copper from some mines they run high enough in silver to pay for the cost of deposition, silver being precipitated to the bottom of the tank when the copper is deposited. But this process will also require the maintaining of the current during the 24 hours, for, if the cell stands without current passing, oxidation takes place and depreciates the value of the deposited copper.

The objection to small plants taking up electro-chemical processes is that they require the employment of labor skilled in the art, which at present commands a very high price. These processes are also susceptible to all sorts of influences, and even in the larger plants troubles arise on the chemical side that seriously interfere with their operation.

Attention may be called in this line to grain elevator and flour mill work, which in a number of localities is only carried on during the day and is shut down when natural light fails due to the fire hazard of artificial illumination. This condition again brings the load on at such periods when the station can supply current at the low rate.

New Interlocking Electric Switch and Signal System.

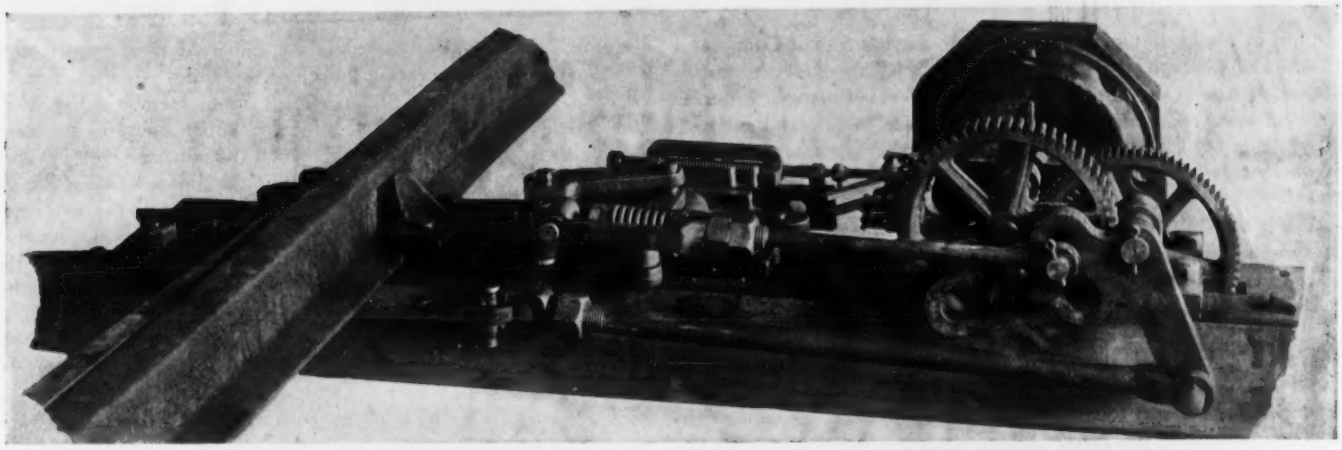
BY J. R. CRAVATH.

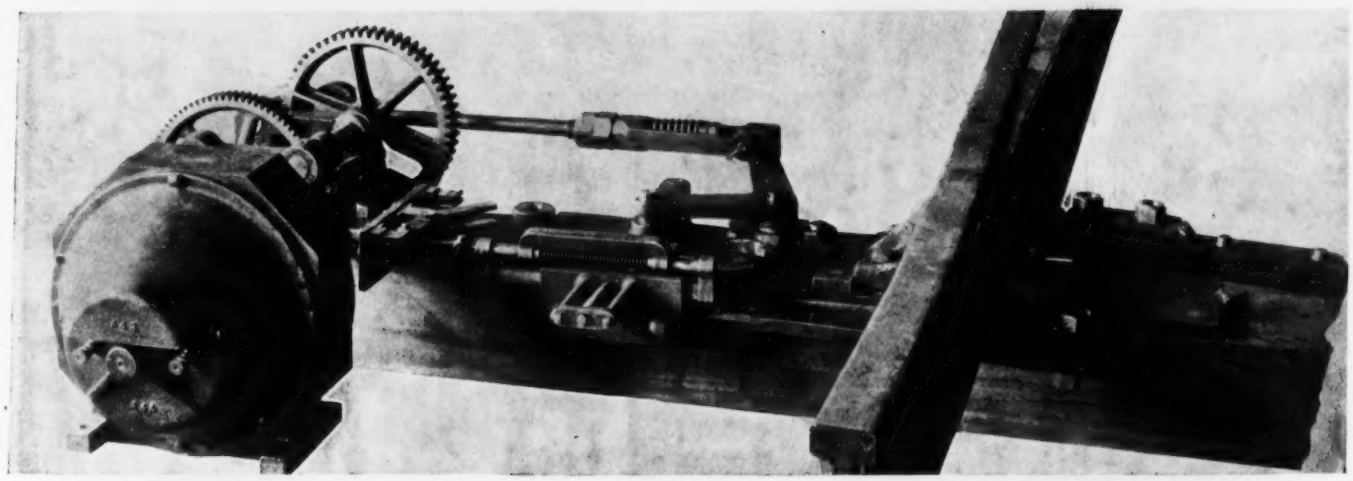
WHEN a new system of interlocking switches and signals for steam railroads is introduced and within a few months captures some of the most important contracts in the field against old and well tried systems, it speaks well for the intrinsic merit of the new apparatus and naturally arouses considerable interest. That is exactly what has been taking place the past few months with the Taylor interlocking system, and it may be a source of some satisfaction to the electrical fraternity that the system that has apparently so easily outstripped its competitors of longer standing is a purely electrical one. As such, it is of interest to the readers of this paper, even though they may not be steam railroad signal men.

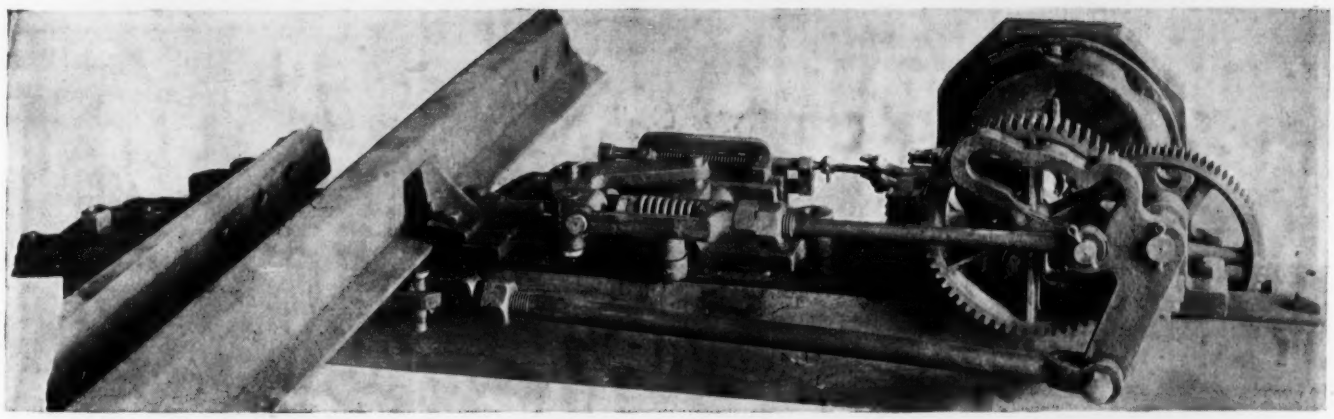
Up to the present time two methods of operating interlocking switch and signal plants from a central tower have been used almost to the exclusion of all others. The most common plan is by manual levers, in which system the switch levers in the tower are mechanically connected to the track switches themselves by a system of rods, chains and levers and the signals are connected to the tower by wires and chains. The objectionable features of the manual interlocking plant are the difficulty of keeping such long and complicated mechanical connections in free and easy working condition, especially in winter, when the obstruction caused by snow and ice is added to the friction of the rest of the apparatus. The other most important interlocking system is the electro-pneumatic, where the control and interlocking is done by electricity acting on electromagnets, which operate compressed air valves to control the compressed air which throws the switches and signals. This kind of an interlocking plant is very rapid in operation, but is usually put in only for large and important interlocking switch towers, where the time required to operate the switches on a manual system would be too great.

The first cost and cost of operation of an electro-pneumatic plant is high, because of the large amount of piping and wiring to be done. The compressed air pipes usually leak a great deal, and a compressor plant must be kept constantly running to supply air; not so much to work the switches and signals as to supply the unavoidable leaks. Although compressed air devices are as a rule reliable, the presence of moisture in pipes and packings makes some trouble in cold weather.

This brief review has been made that the reader may better understand the reasons for the superiority of a system in which electric motors and electric circuits take the place of the compressed air pipes and long mechanical connections of the older systems. The "all electric" interlocking switch and signal operating mechanisms now







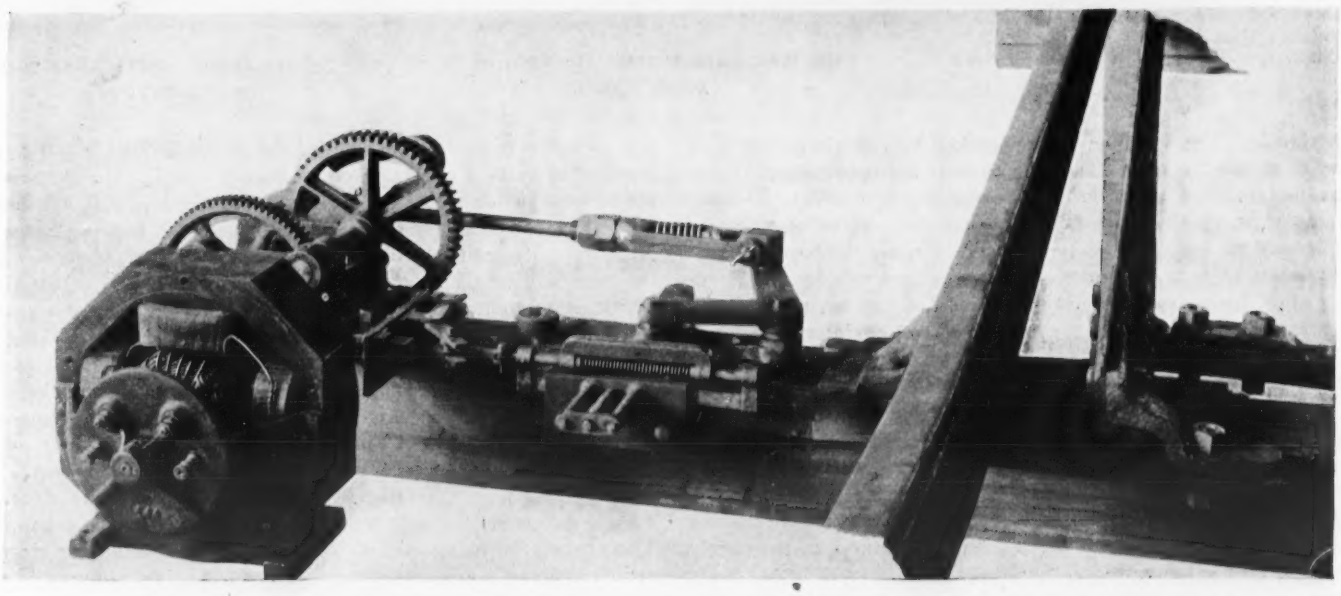


FIG. 1.—SWITCH SHOWN CLOSED. FRONT VIEW.
FIG. 2.—SWITCH SHOWN CLOSED. BACK VIEW.

FIG. 3.—MOTOR AND MECHANISM.
FIG. 4.—MOTOR AND MECHANISM.

worked out in very satisfactory shape by the Taylor Signal Company, of Buffalo and Chicago, is the system recently selected for the large interlocking plant at Sixteenth and Clark Streets, Chicago, for use by the numerous roads entering the Polk Street depot and having freight yards in the vicinity, as well as for a number of smaller towers for various roads. The principle of the purely electric system is simple, and the application is simple, but much work was required on the perfection of details to make it practically operative.

The switches in the Taylor plant are worked by electric motors geared to a mechanism connected directly to the switch rods. The only connections between the tower and the switch are the two wires comprising the motor circuit. Here we see at once two advantages for the electric system. The electric motor being protected from mechanical injury and weather is less affected by bad weather than either manual or pneumatic systems. It has surplus power enough to overcome considerable snow and ice around the switches, and the two wires run in a trough a little above the surface of the ground are not liable to interruption. In addition to operating the switches, it is, of course, necessary to provide for working the semaphores and dwarf switch signals. The semaphores are worked by electric motors and the dwarf signals by solenoids. The current for operating all these devices is furnished by a 60-volt storage battery, which in most towers is of 75 amp-hour capacity. A gasoline engine of 2 horse-power is used to drive a 1-kw dynamo for charging the battery occasionally when needed. The actual energy required to work the interlocking plant from day to day is very small, as can be judged from the figures given later in this article. The cost of operation (by occasionally charging a storage battery in the way just spoken of) is manifestly much less than that of a pneumatic plant where a compressor must be run continuously. Finally, it may be truthfully said, although it will be a surprise to many at first sight, that the purely electric interlocking plant is not only cheaper in first cost and in operation than the pneumatic plant, but is cheaper than a manual plant in first cost. This naturally appeals strongly to purchasing companies, especially when the other desirable features of the purely electric system are taken into account.

Taking up the apparatus now in detail, Figs. 1, 2, 3 and 4 show the motor and mechanism for throwing a switch. This is at first thought a simple operation, but there are a number of rigid requirements to be met in a switch-operating device of this kind. In Figs. 1 and 2 the switch is shown closed, Fig. 1 being a front view and Fig. 2 a back view of the machine. In Fig. 1 the rod which operates the switch is seen below the level of the tie on which the machine rests. When the circuit at the tower is closed to revolve the motor to open the switch, the gear wheel shown at the front in Fig. 1 and at the extreme back in Fig. 2 revolves, carrying with it the pin seen thereon. As the gear revolves clockwise (as seen in Fig. 1) the rod attached to the pin moves to the left in Fig. 1 (right in Fig. 2) until the mechanism shown in the central foreground in Fig. 2 withdraws a pin and unlocks the switch. This done, the revolution of the gear begins to bring the pin into engagement with the slotted piece connected by the bell crank lever to the switch rod (shown at the right, Fig. 1), and as the pin moves up by the revolution of the gear, the switch is thrown open. The motor keeps on revolving the gear, however, until the gear has finished one complete revolution, at which time the switch has been locked again as it was in the first place, and the armature motor connections have been reversed by the quick-break double-pole switch seen just at the right of the motor in Figs. 2 and 4. The position of parts is then as seen in Figs. 3 and 4. The throwing of the reverse switch at the end of the stroke accomplishes a triple object. First, it shuts off current supply from the motor. Second, it establishes a circuit which prepares the track switch to be closed by the reversing of the motor when the circuit is closed at the tower. Third, it temporarily connects the motor to act as a dynamo for working what is called a "back indication" on the interlocking machine in the switch tower (which will be explained later), and for helping stop the motor at the end of the stroke. In case the motor should run a little too far, there is a mechanical arrangement for throwing the motor out of gear automatically, so that no harm will be done. In connection with the switch an indicating instrument is used on all facing points, so that in case a point is not fully closed the signals governing the approach to the switch can not be set to clear. The current taken by one of these motors in opening or closing a switch is about 7 amperes at 60 volts, and the time required is about two seconds. The motor is of a capacity of 1 horse-power to provide plenty of surplus for emergencies.

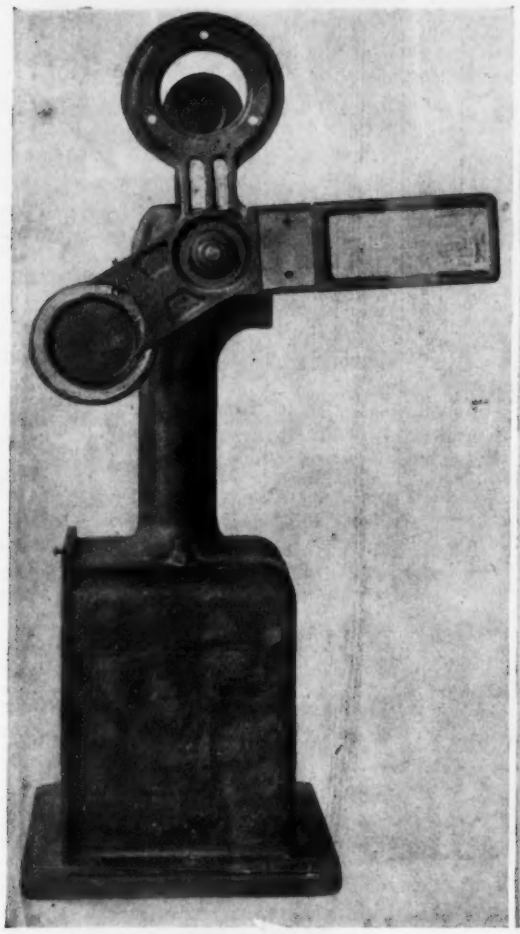


FIG. 5.—DWARF SIGNAL. FRONT VIEW.

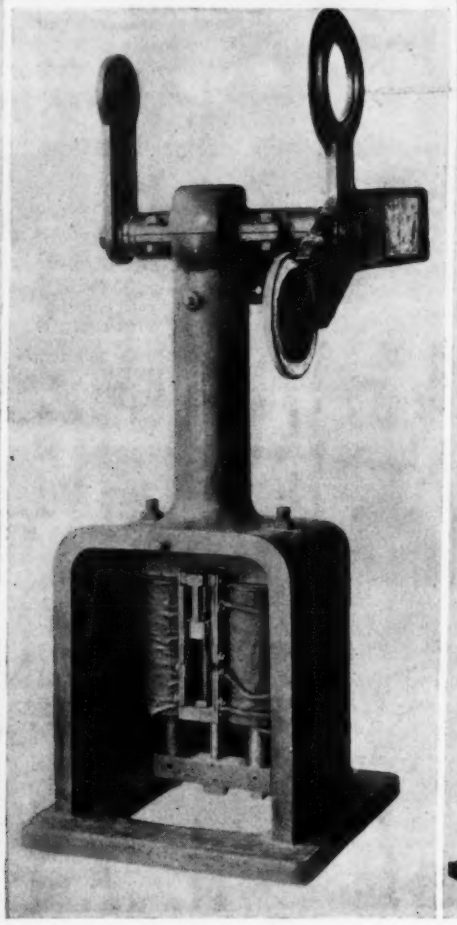


FIG. 6.—DWARF SIGNAL, SHOWING OPERATING MAGNET.

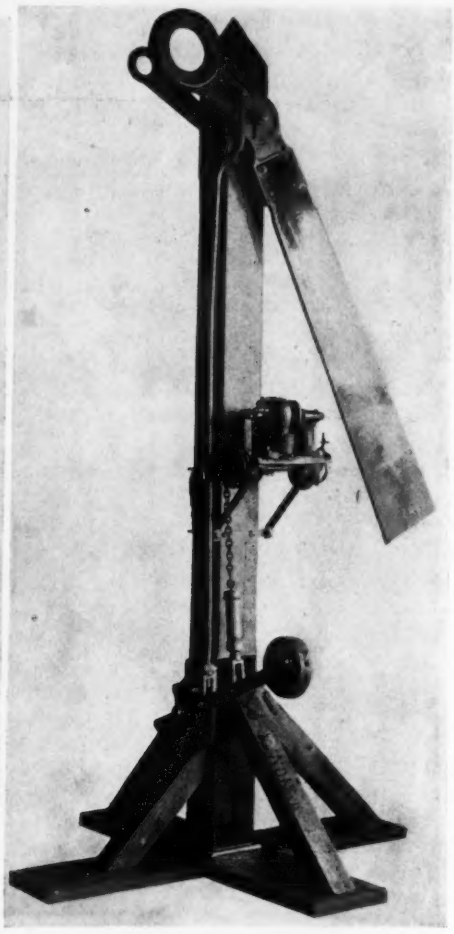


FIG. 7.—SEMAPHORE SIGNAL AND MOTOR FOR OPERATING IT.

To indicate the position of a switch, the dwarf signal seen in Figs. 5 and 6 is used. The solenoid for clearing the dwarf signal is plainly seen in the hollow base, Fig. 6. This solenoid has two windings, one of low resistance and one of high. To pull up the signal to "clear," the low resistance winding is used, which takes about 6 amperes at 60 volts. When it is almost cleared the low resistance winding is automatically put in series with the high, and the signal held at clear with one-quarter ampere, as the magnetic circuit is then nearly closed and but a small amount of energy is required.

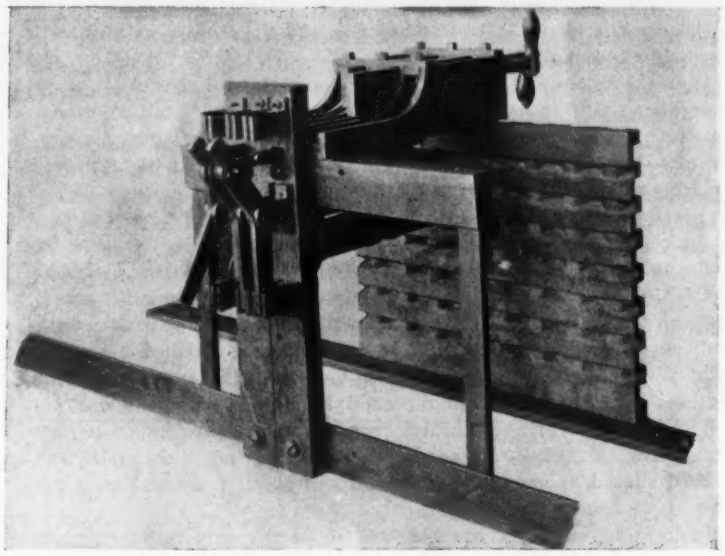


FIG. 8.—INTERLOCKING MACHINE.

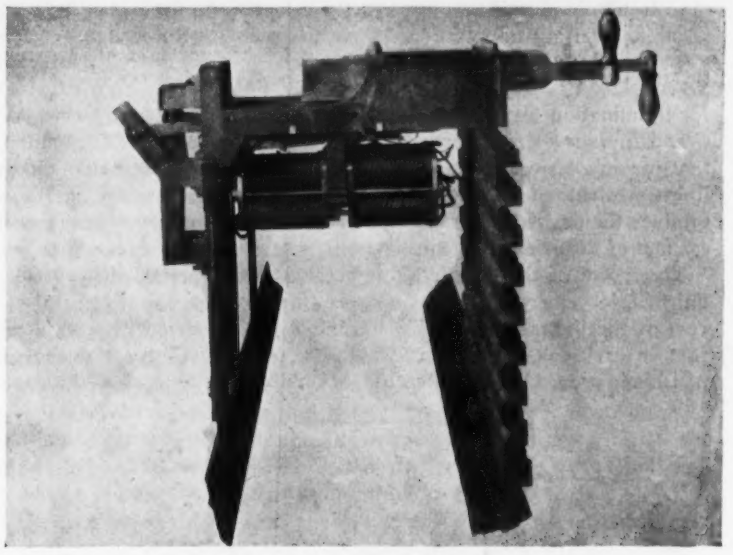


FIG. 9.—INTERLOCKING MACHINE.

To work the standard 5½-ft. semaphore blades, a mechanism like that shown in Fig. 7 is put up. It is a one-sixth horse-power motor geared to a winding drum which pulls the blade to the clear position. When the signal is at clear, a cam on the winding drum shaft throws a switch which throws the magnet clutch coil (shown at the right of the motor, Fig. 7) in series with the motor, causing it to grip the disk on the motor shaft and hold the signal at clear as long as the circuit is closed. The current necessary to clear the semaphore in 2½ seconds is about 2 amperes at 60 volts, and to hold it one-tenth ampere at 60 volts. The signal is, of course, returned to danger position by gravity, as are all signals.

The only remaining device of importance in the electric interlocking system is the interlocking machine in the tower, a section of which is shown in Figs. 8 and 9. The horizontal movement of the handles throws the electric switches mounted on the panels on the back. The interlocking which prevents clear signals being given when switches are not in the right position is done by purely mechanical means on old well-known principles. One important feature of the machine, and one that adds much to its safety, is the "back indication," as it is called by signal men. When the tower man pulls the handle (commonly known as "the lever" among signal men) to throw a switch he cannot at first throw it the full length of its stroke. As soon as the handle has gone far enough to throw the motor circuit, it is caught, and cannot be shoved home to unlock the handle that will give the clear signal until the current from the switch motor, acting as a dynamo at the end of its stroke, energizes the back indication magnets underneath and releases the bar. The switch must, therefore, be positively opened or closed before any movement corresponding to it can be completed in the interlocking tower.

Fig. 10 shows the arrangement of circuits for the system. Of course, all outdoor mechanisms are covered over. A sheet-iron box covers the switch motors and a cast-iron box the semaphore motors on the poles. The wires are run in wooden troughs (or "trunking," as block signal men call it) above the surface of the ground—the insulation used on the wire depending on local conditions.

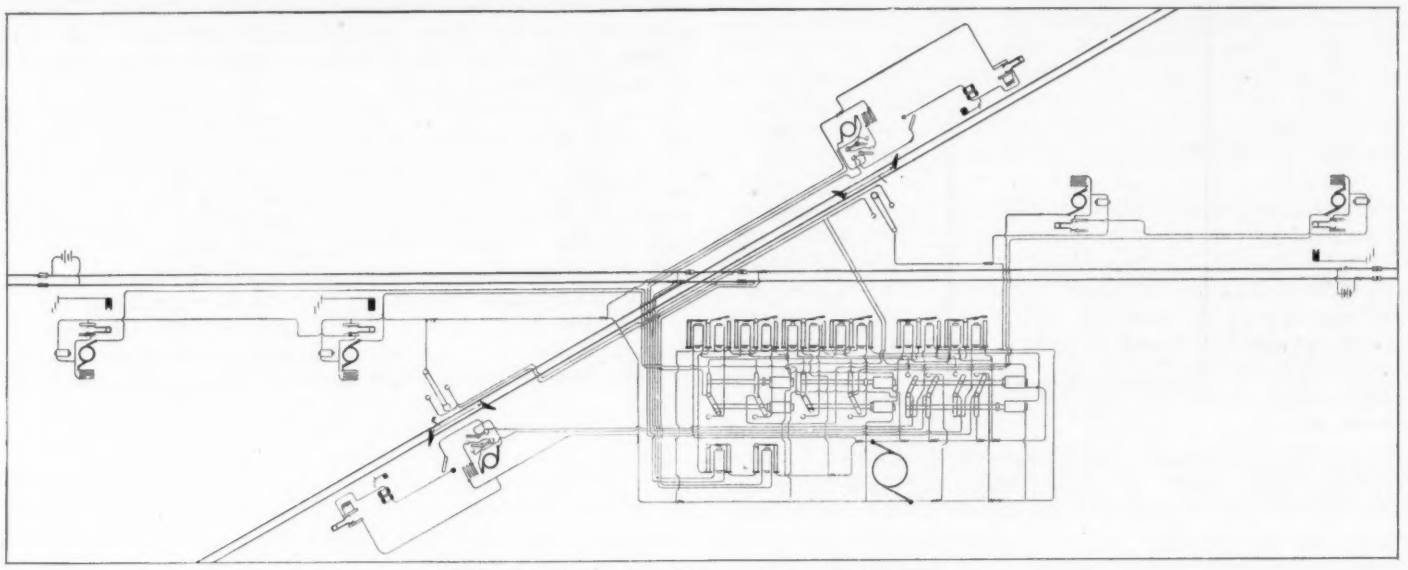


FIG. 10.—DIAGRAM OF CIRCUITS OF THE SYSTEM.

Wireless Telephony.

A special cable despatch to the daily press from Bradford, England, of Sept. 8, says: At to-day's session of the Physical Science Section of the British Association for the Advancement of Science, now in annual session here, Sir William Henry Preece made the interesting announcement that as a result of his experiments with wireless telegraphy he had found it quite possible to convey audible speech six to eight miles across the sea without wires. He added that it was a practical commercial system and might be extended to communication between ships and between ships and the shore.

Elements of Illumination—X.

BY DR. LOUIS BELL.

TO follow up the effect of raising the lights in a high room still further, it is well to note that the critical point is the amount of available diffusion. If one were dealing with a room lined with black velvet, or with translucent walls, in which there is only a very minute amount of diffused light, raising the lights would diminish the illumination almost exactly according to the law of inverse squares. Writing now K for the coefficient of diffusion denoted by the fraction $\left(\frac{l}{l-k}\right)$ and recurring to the formulæ previously given for illumination we have at once $K\,C = L\,d^2$, and for fixed values of C and L, $d = P\sqrt{K}$, where P is a constant. Hence we may conclude that for any desired value of the illumination with a fixed amount of lights available the height to which these lights can be raised and still produce the desired effect is *proportional to the square root of the coefficient of diffusion.*

The moral of this is tolerably obvious. If one deals with a dome finished, let us say, in white and gold, it may be permissible to place part of the lights fairly highly up, while in a church with a vaulted roof in dark oak, lights placed high are nearly useless for purposes of illumination. In such a case lights placed at the level of the roof

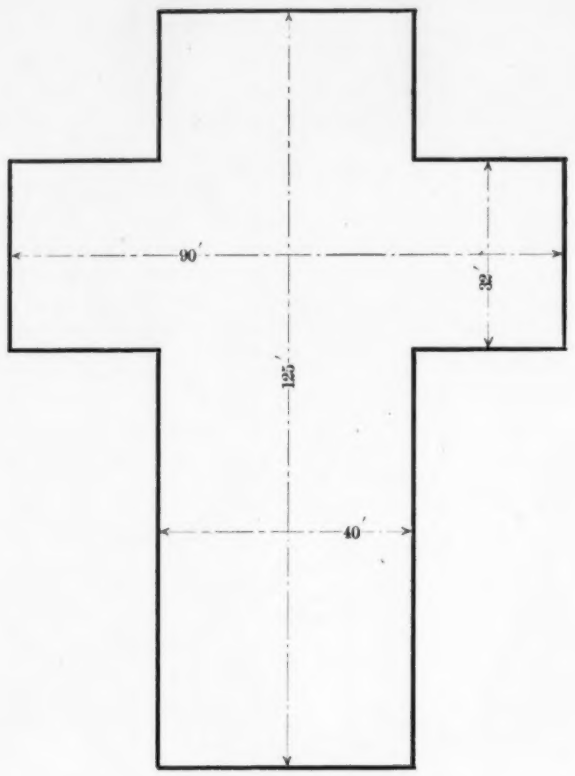


FIG. I.

beams and unprovided with reflectors have barely more than a decorative value and should be treated essentially as a decorative feature, useful for bringing out the details of the architectural design. Any real illumination must be accomplished by lamps with reflectors or by lamps placed down nearer the plane of illumination. In these dark interiors reflector lamps can be used to especial advantage, since the coefficient of diffusion is so small that the lessened diffusion due to the partially directed beams from reflector lamps is of trivial consequence. In fact, there are few cases in which reflectors cannot be used to advantage in rooms having very high roofs.

Churches are generally badly lighted and are, in fact, rather difficult if of any considerable size. They are seldom brilliant in interior finish, usually have rather high vaulted roofs, and require good reading illumination. The few cases in which their form approximates to Fig. 1 of the last section of this article may easily be treated as there indicated, but such is not the usual condition. Fig. 1 gives a roughly typical church floor plan as regards the main body of the building. The total floor space is shown as 5000 sq. ft. in the nave and choir combined and 800 sq. ft. in each transept. The walls are assumed to be 30 ft. high in the clear, with a Gothic roof above. Now the total area to be lighted is 6600 sq. ft., and the value of K is low, not safely to be taken as exceeding 1.20. The peculiarities of the building, as a problem in lighting, lie in the high walls and the absence of any ceiling, both of which complicate matters.

As to the nature of the radiants, when electric lights are available, one must depend almost entirely upon incandescents. Arc lamps are not to be considered for artistic reasons, save perhaps in indirect lighting of the choir. If only gas is available, mantle burners suitably shaded had better be the main reliance, as ordinary gas flames are seldom steady in such a place. In either case avoid chandeliers as you would shun poison. A huge circlet of lights pendent from a Gothic roof is about as bad technically and artistically as anything that could be imagined.

As to the amount of light needed, it would be advisable to allow no more than 2.5 sq. ft. per candle-power, which, taking K at 1.20, would call for 2200 net candle-power. In point of fact, in using electricity, not less than 150 16-cp lamps should be used, and even this number, on account of the trying conditions, would have to be very deftly arranged to give the required result. For the best effect they should all be reflector lamps, assigned about as follows: 90 to the nave, 20 to the choir and 20 to each transept. As to position, the most efficient method would be to put them in groups of six or eight on brackets between the windows, at half to two-thirds the height of the wall, with possibly larger groups massed at the four corners of the crossing. With still more lights available very beautiful results could be attained by adding lights at the capitals, and, in some cases, along the tie-beams, or on the brackets from which the pendant posts rise. These latter arrangements are very effective but not economical, and if used should be installed on the basis of about 1 candle-power per 2 sq. ft. of floor surface.

In lighting with gas, brackets are about the only resource, since the flames must point upward, and few capitals would fail to look overloaded with adequately shaded burners. Mantle burners, of course, do the work most efficiently, but used alone the effect is apt to be grimly utilitarian and especially around the choir small ordinary jets may be used to very great advantage. The mantle burners should be as unobtrusive as possible in such a case, even if they do the main work of the illumination. Only the barest hints can be given for the detail of church lighting, as so much depends on the architectural peculiarities and on the scheme of decoration, but the foregoing indicates the general principles to be followed. The most important thing is to give a rather brilliant illumination without the individual radiants obtruding themselves unpleasantly on the eyes of the congregation.

Large public buildings are generally easier to light than churches, since they are as regards the shape of the several rooms, comparatively simple and are seldom dark in finish. Many rooms may be illuminated along the lines already laid down, but, on the whole, powerful radiants, such as arc lights, may be more freely used here than elsewhere, thereby introducing a very considerable economy. In high corridors and high halls without galleries arc lights can be used with very excellent results. They should invariably be shielded by ground or opal globes, and, if hung very high, as is sometimes desirable to keep them out of the ordinary field of vision, should be provided with reflectors. They should be numerous enough to suppress the shadows that ordinarily exist under the lamps. In the absence of such shadows the modern enclosed arcs have a very material advantage.

Rooms lighted by arc lamps ought to be of light finish, since the lamps must be placed rather high to keep them, even shaded, from glaring unpleasantly, and they give a strong horizontal beam which, in lack of good diffusing surfaces, is for the most part wasted. Reflectors deep enough to turn this downward would usually be most unsightly and would give an unpleasant searchlight effect, which had better be avoided.

Never let the eye rest simultaneously on arc and incandescent lamps indoors, since the latter seem very dim and yellowish in such company, and will never be credited with anything like their real brilliancy. Similar reasoning applies to the use of mantle burners and ordinary gas jets in the same room. When so used the former should be well shaded and unobtrusively placed and the latter massed and generally unshaded or lightly shaded, so as not to seem of relatively very small intrinsic brilliancy.

Sometimes in large interiors the powerful regenerative burners may find a place. They give an excellent downward illumination, which is sometimes very useful.

Theatres present some very interesting problems in illumination on account of their peculiar shape and the difficulty of lighting the interior with sufficient brilliancy without making the radiants alto-

gether too conspicuous. They are, as a rule, far more brightly lighted than other interiors, but seldom judiciously. The usual fault is to place the lights so that they shine directly in the eyes of a considerable part of the audience. The auditorium is commonly very high in proportion to its area, and plentifully supplied with galleries. Fig. 2 shows the typical elevation, the floor plan being generally only slightly oblong. The galleries, of course, sweep around the sides, narrowing as they near the proscenium boxes. Not unfrequently a fourth gallery is added. During the acts no very considerable amount of light is needed, but between them it is generally desirable to produce an effect of great brilliancy. The main floor is far below the roof, and the shelving galleries render it difficult to light the spaces between them. The general fittings are usually light, but the dull hue of the floor and galleries when occupied kills much of the diffusion. The actual floor space to be dealt with as a problem in illumination includes the galleries, and hence greatly exceeds the area of the main floor. Assuming the width in Fig. 2 to be 50 ft., the nominal area in front of the footlights is 3000 sq. ft. The total gallery area is usually from 1 to 1.25 times the floor space, so that the entire space to be lighted would be at least 6000 sq. ft., half of it being located so that it can get little advantage from the illumination of the main space above the floor. The space behind *A*, and the galleries *B*, *C*, and to a less extent *D*, have to be treated almost as separate rooms,

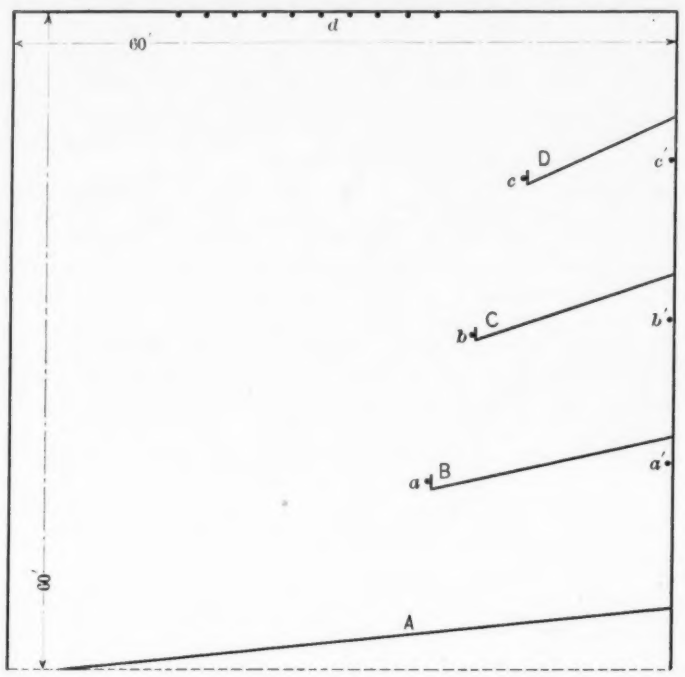


FIG. 2.

particularly when, as sometimes happens, the galleries are rather lower than shown in Fig. 2.

This is the main reason for the apparently abnormal amount of light that is needed in theatres. The fact is that there is really a very great area to light, and it is so placed that it cannot readily be treated as a whole. The following table shows the approximate amount of illumination furnished in a number of prominent Continental theatres:

Theatre.	Sq. ft. per c. p.	C. p. per sq. ft.
Opera, Paris	0.78	1.28
Opera, Paris, as ballroom	0.38	2.63
Odéon, Paris	1.52	0.66
Gaîte, Paris	1.14	0.87
Palais-Royal, Paris	0.51	1.96
Renaissance, Paris	0.52	1.92
La Scala, Milan	1.07	0.93
Massimo, Palermo (ordinary)	0.86	1.16
Massimo, Palermo (en fête)	0.53	1.88

If in Fig. 2 we allow, on account of the high ceiling and conditions unfavorable for diffusion, 2 to 2.5 sq. ft. per candle-power and take account of the real total floor space, including the galleries, we reach just about the figures given above, which are based on the floor plan only. And in practice 3600 candle-power would probably do the work well, although since this only allows ordinary good reading illumination, more light is necessary to give the really brilliant effect which is usually desired. Nearly 5000 candle-power would be required to show off the house effectively.

As to the location of the lights and their character, the body of the house can be usefully lighted by lamps ranged along the galleries at *a*, *b*, *c*. If these are placed below the edges of the galleries they will glare directly into the eyes of the spectators, so that it is better to illuminate the gallery spaces from the rear and above, at *a'*, *b'*, *c'*. These should be reflector lamps, as the diffusion amounts to little, and all lamps on and under the galleries should have, if incandescents as usual, ground globes. These lights may be reinforced to great advantage by ceiling reflector lamps, best sunk in the ceiling enough to make them inoffensive from the galleries. These, with some ornamental lighting about the stage and boxes, should give a capital result. The main point is to light the interior brightly without thrusting bright radiants into the field of vision.

A useful form of ceiling lighting, applicable to many very high interiors, is arranged by replacing the lamps at *d*, Fig. 2, by opal glass skylights of rather large dimensions, and placing above them arc lamps with reflectors. The skylight surfaces should be flat or slightly projecting rather than recessed, and the reflectors should be planned so that each may throw a cone of light subtending an angle equivalent to the whole floor plan. By thus superposing the indirect illumination from a group of lamps the general steadiness of the light is greatly increased. In thus using arcs care should be taken to have the diffusing skylights faintly tinted so as to lessen the color contrast between the powerful ceiling lights and the incandescents used elsewhere in the house. It is a considerable advantage thus to place lights above the ceiling, as it avoids the serious heating effect due to massing incandescents near the ceiling of a generally overheated room.

On account of this heating the use of gas in theatres is highly undesirable, and has been almost completely abandoned. In lack of anything better, fair results could be reached by mantle burners placed somewhat as shown in Fig. 2, and *very thoroughly* shaded by holophane or diffusing globes, much of the illumination being located above the ceiling in the form of mantle or regenerative burners.

Large and high spaces cannot often be lighted very efficiently, as the conditions preclude ordinarily placing powerful radiants near the plane of illumination. The natural *riposte* is to use highly efficient radiants and to employ reflectors freely. Hence the form of ceiling illumination just explained.

In very large interiors without high galleries, arc lighting may be very effectively used, provided the arcs are well shaded. It is wise to group them so that no single arc shall entirely dominate the illumination at any particular point. It is better to lose a little in uniformity of the total illumination throughout the area than to take the chances of flickering, which is not entirely suppressed even in the best arc lamps.

In a big space arcs can be treated much like incandescents in a small space, but the detail of the work varies so much that only very general suggestions can be given. Often temporary illumination has to be undertaken and must be fitted to the case in hand. One of the most beautiful examples of such work that ever fell under the author's notice was the illumination of Madison Square Garden for a chrysanthemum and orchid show a few years since. The feature of this work was the very extensive use of both arc and incandescent lamps enclosed in Chinese lanterns. The huge lanterns containing the arcs were very striking, and the whole effect was most harmonious, while the illumination was thoroughly good. It is merely mentioned here as a clever bit of temporary lighting treated to suit the particular occasion.

In this lighting of large interiors the smaller arcs worked on constant potential circuits are very useful, although not very efficient. Those taking 5 to 6 amperes give excellent service, and good results can be obtained with lamps working down even to 4 amperes. Such arcs are equivalent to from 12 to 20 16-cp lamps in practical effect, and give a greater candle-power per watt.

Incandescent lamps of the Nernst type, if reduced to a practical form, may be utilized in a similar way, forming a good basis of illumination where the total amount of light is considerable. In other words, when one is dealing with very large enclosed spaces the lighting is simplified and made more efficient by utilizing the more powerful radiants. Large incandescent lamps giving from 50 to 100 candle-power, or even more, would be very valuable but for their high cost and generally rather inadequate life and efficiency. Those of 50 candle-power are pretty satisfactory, in spite of their share of these drawbacks, but the larger sizes are much less advantageous. In certain cases, particularly railway stations and other buildings likely to be rather smoky, arcs have to be the main reliance, since the globes

of incandescents grow dim so quickly that cleaning them is an almost interminable job. Hence it is best to use comparatively few powerful radiants. The arcs should be carried rather high, say 20 to 25 ft. above the ground or floor. Assuming 0.5 candle-foot as the minimum, and taking into account the illumination due to adjacent lamps, each arc can be counted on to illuminate over a distance at which it gives 0.25 candle-foot. For close detail reference must be made to the actual illumination curves of the type of lamp used, and the general problem is analogous to street lighting, but for lamps 25 ft. above the floor the approximate distance between arcs of the commoner kinds, to give the required illumination, may be derived from the following table:

Kind of arc.	Approximate watts per arc.	Distance between arcs.	Sq. ft. per arc.
Direct current, open, 6.6 amperes	330	80	6,400
Direct current, open, 9.6 amperes	480	105	11,025
D. C. enclosed, 6.6 amperes	480	90	8,100
Alternating enclosed, 6.6 amperes	425	75	5,625

The alternating arc would do relatively better if placed, say, 20 ft. high, since its light is thrown more horizontally, and since all the arcs are assumed in this table to have clear outer globes, the open arcs if given pale opal globes, which they should have to lessen the unpleasant glare, will be about on a par with the enclosed arcs. All arcs in enclosed places should have at least one opal globe, and when used where, as in railway stations, diffuse reflection is of small amount, should be provided with reflectors to utilize the light that would otherwise be wasted. This would somewhat improve the figures given above, and it is quite safe to say that under ordinary circumstances, with properly placed arcs, one arc taking about 6.5 amperes is good for about 10,000 sq. ft. of floor space at the assumed intensity of illumination. More lights are often desired locally, but they seldom would have to be placed nearer than 60 ft. apart.

International Electrical Congress.

(From Our Special Correspondent.)

THE work of the International Electrical Congress of 1900 was terminated on Friday, Aug. 24, by the final adjournment of the sections, and the congress formally dissolved the next morning at a general meeting. A considerable number of papers remained unread, which will be printed in the report of the congress. This report will also include the main points of the discussions in the several sections. Owing to the congress being divided into seven sections and sub-sections, meeting simultaneously, and to the fact that most papers were not printed, while some had not passed beyond the stage of notes, even those in attendance at the congress will have to await the appearance of the report to obtain a full knowledge of the proceedings.

The most important work accomplished was, as noted last week, the giving of names to the magnetic c. g. s. units of field intensity and flux, which was brought about through the advocacy of the American delegates, and particularly of Messrs. Kennelly and Mailloux. The favorable action on Thursday of the section which had cognizance of the subject of units was confirmed on Friday at a meeting of official delegates, and on Saturday morning the president of the congress announced the result. As finally adopted, the name of Gauss is applied to the c. g. s. unit of magnetic intensity, and that of Maxwell to the c. g. s. unit of magnetic flux.

The general meeting on Saturday convened with President Mascart in the chair. Shortly after opening, Mr. Mailloux was given the floor, and extended an invitation to European electrical engineering associations to hold a joint meeting in America next year at Buffalo during the Pan-American Exposition. M. Boschau followed with a proposition to hold an international electrical congress in Vienna in 1903. President Mascart supported the proposition of Mr. Mailloux, and referred in warm terms to the many courtesies shown to those from abroad who attended the Chicago congress. M. Mascart then delivered an address in which he sketched the work of the congress, and referred in complimentary terms to the excellent contributions of its one member of the fair sex—Mrs. Ayrton. He also expressed the regret that doubtless all had felt at the absence, through sickness, of two brilliant members, MM. Blondel and Moissan, the first mentioned being the contributor of a number of papers of the highest value.

At the end of M. Mascart's remarks, Mailloux and Millis, for the United States, Ayrton for Great Britan, Kohlrausch for Germany, Gerard for Belgium, Turrettini for Switzerland and de Fodor for Hungary, expressed thanks for the many courtesies shown to the foreign attendants on the congress.

Of the several sections the most popular, judging from attendance, is Sub-section A of Section II, which deals with the production and mechanical utilization of electricity. The first paper read before this section was one by M. Bede, who gave an account of an electric railway system for some time on trial in Brussels. The conductor is placed in an iron conduit located alongside of one of the rails, from which it is separated by a groove about one inch wide. A plow travels in this groove, and spaced every three feet are contact buttons by means of which current is obtained for the motor. The contact device consists of a button-headed rod which, when depressed, makes contact with a portion of the cable opposite from which the insulation has been removed. This contact piece is held in a rubber cork, the function of which is, first, to support the above; second, to seal the conduit containing the conductor, and third, to act as a spring to break the current when the plow passes away. Normally the contact device is one-eighth inch distant from the conductor. M. Bede stated that the trial of the system has shown the insulation is well maintained; the passing of carriages has no adverse influence; no difficulty is found in keeping the groove clean, and there has been no accident to man or beast.

M. Rey, electrical engineer of Saulter-Harle Company, followed with a paper on the predetermination of drop in alternators by the method of "two reactions"—one direct, produced by the wattless current, and the other transverse, produced by the energy current. The application of this theory—due to Prof. Blondel—in the case of an inductor alternator, gave results which coincided in a remarkable manner with those subsequently obtained by direct measurement. The alternator in question had the marked peculiarity that the two reactions were very unequal in value, and consequently the theories assuming an equality would not have applied.

M. Rey then read a paper on "Compounding of Polyphase Alternators," by Prof. Blondel, who is debarred from attendance on the congress by a severe illness. The brilliant professor of the Ecole des Ponts et Chauseés had prepared a number of papers for presentation, and the high estimation in which he is held is indicated by the expressions of regret at his absence.

The system of compounding proposed by Prof. Blondel consists in employing a direct-current exciter, through the armature of which is passed the alternator current, either in whole or, by means of a transformer or shunt, in part. The theory of the method was outlined, and the conditions were given which the exciter should fulfil for circuits either inductive or non-inductive. This method was first described before the Geneva Congress of 1896, and experimentally demonstrated as correct by appliction to a 400-kw machine with high armature reaction.

M. Thury then followed with a paper on the automatic charging of storage batteries from constant potential circuits. In series with the battery a booster is mounted which varies in e. m. f. at the same rate as the battery. The field of the booster is reversed between two equal limits in passing gradually through zero, thus enabling the e. m. f. of the booster to be varied 50 per cent. The variation of the full strength is effected by an automatic regulator, consisting essentially of a mechanical servo-motor. To avoid sparking at the commutator, the machine has a short armature with smooth winding, a large air-gap and a multipolar field.

In Sub-section B of Section A, the first paper presented was one by Prof. Blondel on "Progress in Electric Lamps," the main points of which were outlined by M. Laporte. This interesting paper gave rise to a discussion extending at intervals over several days.

Mrs. Bertha Ayrton read a paper on the candle-power of direct-current arc lamps, in which is discussed the variation of the candle-power with length of arc. It was shown that the small arc, whatever the current, has the highest light-giving efficiency, though this advantage is, with present forms of carbons, obscured. To benefit from the advantage, carbons should be used giving the smallest possible arc and in connection with the largest possible current; and a negative carbon found which will present to the arc an extremity longer and thinner than that of carbons now employed, but which will nevertheless burn much more slowly. The paper develops that at least one of the reasons for the lesser efficiency of the longer arc is that as an arc is lengthened the carbon fog about the arc is increased, which results in an absorption of light.

In the discussion of Mrs. Ayrton's paper, M. Bochet recalled that Prof. Blondel ascribed the reduction of the brilliancy of the crater with reduction of current, to the cooling of the arc when operating in the open air. Mr. Arnoux said there would be difficulty in securing

stability with an arc of the length corresponding to maximum efficiency. Prof. S. P. Thompson considered that Mrs. Ayrton's theory gives an explanation for the turning arc observed by Trotter, which is probably due to vortices formed of carbon dust; and to the counter e. m. f. of the arc, the carbon vapor giving rise to a high resistance.

On Friday afternoon Mrs. Ayrton delivered, at l'Ecole Superieure d'Electricité, a lecture, during which a number of experiments were shown demonstrating the powerful absorption of carbon vapor produced in an arc.

In Section IV (Telegraphy and Telephony), two papers were presented on Monday—one by M. André on the central battery telephone system, and another by Dr. Rudolph Blochmann on the question of signal selection in wireless telegraphy. The first mentioned paper described the central battery system in detail, and other improvements in telephone exchanges, such as the use of luminous signals, supervising signals, etc.

Prof. Blochmann gave the following theory of wireless telegraphy; The terrestrial sphere is surrounded by equi-potential surfaces. When electrical disturbances are produced along an aerial conductor such as is employed in wireless telegraphy, the equilibrium of the equi-potential surfaces is affected in the same manner as a surface of water is affected when a stone is let fall on it. In both cases waves are produced which are propagated, and in the former case will affect an aerial conductor connected to a receiving apparatus. The author advances three arguments to sustain his theory, as follows: Horizontal receiving conductors cannot be employed, nor a conductor hanging from a high edifice, and messages have been transmitted to distances such that rectilinear propagation would appear impossible on account of the curvature of the earth. In conclusion, the author said that if the above theory is correct, selective signaling by wireless telegraphy is impossible. In reply to a question by Capt. Ferrié, why transmission is better between two stations separated by water than if separated by earth, Prof. Blochmann said that equi-potential surfaces are much more regularly distributed above the surface of water than in the interior of earth elevations.

After the organization of Section V (Electro-Physiology) it was decided that several papers offered dealing with the use of electricity in the cure of tuberculosis had no direct relation with electrical science, and they were consequently not accepted. M. Stanoievitch then presented a paper on the analogy between the constitution of magnetic and electromagnetic lines of force, and the markings of transverse sections of certain plants. An album of photographs (also exhibited the same evening in the library of the hotel of Prince Roland Bonaparte) showed striking similarity between the marking of such sections and charted lines of force. An oak section, for example, corresponded in its markings to equi-potential surfaces and radiating lines of force. M. Stanoievitch, in conclusion, said that organic cells obey Maxwell's law, acting upon each other according to their masses, and inversely as the square of the distance. In the discussion which followed, M. Bergonie, while admitting the analogy described, rejected the generalization.

The paper of M. Stanoievitch was the only one accepted by Section V, which held no further sessions.

In the remaining portion of this report the order of presentation of papers will not be observed, nor mention made of the sections before which they were read.

Mr. W. H. Hildeburgh, in a paper entitled "Asymmetrical and Irreciprocal Conductors," considered the subject under the heads of mechanical, physical and chemical. Rectifiers and rotary converters were classified under the first head, unsymmetrical currents in arcs and various other subjects under the second head, and electrolytic and similar cells under the third head. The concluding portion of the paper deals with the application of this type of apparatus, and particularly of the kind classified as chemical in their character.

M. Arnoux, in a communication on standards of e. m. f., stated that the Clark cell, adopted by the Chicago Congress, has grave defects as a standard of e. m. f. on account of its large temperature coefficient and large variations in internal resistance. M. Arnoux favors the cadmium cell, and in the cylindrical rather than H form, since the former may be made of much smaller resistance, thus permitting the use of less sensitive and more portable galvanometers.

M. Weyde presented a paper on the mechanical nature of electrical phenomena as based upon the theory of Maxwell and the vortex theory. An interesting apparatus was exhibited, designed to reproduce mechanically the effects of a direct or alternating e. m. f. in a circuit containing resistance, self-inductance and capacity, a registering system taking account of the effects produced when one or more of the elements of the circuit were varied.

In a paper entitled "Electromagnetic Mechanisms," Prof. S. P. Thompson classified such mechanisms under 17 heads, and gave a résumé of the general principles of operation of electromagnetic devices, which he formulated in the following law: In every electromagnetic system, whatever its configuration, and traversed by an electric current, there are always mechanical forces which tend to change the configuration in such a manner as to render the magnetic flux a maximum. This principle may be presented in several forms. For example, in electromagnetic systems there is always a tendency toward a reduction of reluctance; or the several organs tend to take a relative position such that the coils will embrace the largest number of lines of force; or the forces tend to cause an arrangement of parts that will augment the product of the current by the magnetic flux with which it is interlinked, as in the case of the motor, each coil of which tends to place itself across the field, this tendency being overcome by the commutator. Alternating current apparatus do not furnish an exception to the principle; if we consider the action of the secondary currents set up. For example, in the case of a copper disk repelled by the pole of an alternating current magnet, the parasite currents induced in the disk, being opposite in direction, tend to diminish the magnetic flux in the circuit. According to the fundamental law, the tendency is to augment the flux to its maximum value, and we expect to find mechanical forces between the several parts of the system such as to tend to neutralize the effect of these inverse currents in diminished flux. In fact, there is a repulsion between the disk and pole.

In the discussion of Prof. Thompson's paper, M. Gueree said he had succeeded in producing electromagnets of minimum reluctance by employing an armature consisting of a cylinder surmounted by a series of iron disks or cylinders separated by copper disks, the thickness of which can be regulated. By this means a constant or maximum effort may be produced over a relatively long travel. An electromagnet of this kind gave a constant effort of 1320 lbs. over 9 ins. of its travel.

M. Maurice Leblanc presented two papers before the congress, one on the construction of dynamo-electric machines, and the other on the excitation of induction machines. In the first paper the principle is laid down that the reluctance of the dynamo should be reduced to a minimum. In the case of a direct-current machine this may be done by having a toothed or ironclad armature with a cylindrical field frame, the winding of which is laid in longitudinal grooves in the interior surface—the armature and field cylindrical surfaces being separated by a very small air-gap. In other words, the field winding is similar to that of an induction motor. To annul the armature reaction, a Thompson-Ryan winding is added to the field, which winding, as applied to the proposed design, will give greater benefit than when applied to an ordinary dynamo with large air-gap.

In the case of alternators, to utilize the principle of minimum reluctance, it is necessary that the variation of the excitation with the load should be accomplished automatically, as in the case of direct current compound machines. M. Leblanc then proceeded to describe his alternating-current exciter, which forms one of the most interesting exhibits in the electrical department of the Exposition.

Two ring armature cores are secured to the same shaft, which is driven in synchronism with the alternator to be excited. The larger of these cores has a winding placed in series with the main alternator circuit, by means of collector rings, and the winding of the smaller core is similarly connected in shunt with the main circuit. Over both cores and windings is a third or direct-current winding connected to a commutator, which supplies the alternator exciting current. Each ring has a separate field excited by direct current, that of the series ring being kept under-saturated, while the field of the shunt ring is kept saturated. The paper gives the method for designing an exciter of this kind for different types of alternators. In conclusion, the author states that with this method of excitation, the voltage of an alternator may be kept constant at all loads, and without attention to the brushes of the exciter.

Two of M. Leblanc's machines of this type are on exhibition at the Exposition, both constructed like an induction motor. One is a direct-current machine, and the other an alternator of 75 kilowatts. In addition there is a 1000-kw alternator with poles, excited from a machine such as is above described. This work has already been described in ELECTRICAL WORLD AND ENGINEER.

The second paper describes a method for the operation of excitation

of induction machines—that is, generators constructed along the lines of induction motors, with a short-circuited armature winding. M. Leblanc considers that this type of machine has valuable properties. They can be coupled both in series and parallel, and without the necessity of running in synchronism. Assuming the case of a central station, there would be as many induction generators as desired, and also one regular alternator excited as described in the preceding paper—this machine acting as "chef d'orchestre" to fix the frequency of the current from the induction machines. The exciter for the inductor machine consists of two direct-current machines on the same shaft, each having a field with two windings. The connections of these several windings is not made clear by the paper. In operation, light load would be carried by the alternator; as the load became heavier an inductor would be thrown in, which would immediately take the load from the alternator. As the load increased, the alternator would again take a portion, which would be transferred to another inductor when switched in.

M. Ernest Gerard, engineer-in-chief of the Belgian State Railways, gave a tractive formula for single cars as follows:

$$f = 1.80 + .04\ V + \frac{.0415}{T}\ V^2 \pm m,$$

where V is the speed in kilometres per hour, m the grade in millimetres per metre, and T the weight in tons. This formula is the result of experiments by the Belgian Government on self-propelled cars.

Prof. Blondin described an electric railway surface contact system now being operated over a line a quarter-mile long in the outskirts of Paris, and known as the Dolter system. The car magnet or shoe is excited by the current operating the car or from a small storage battery on the car. In passing over a box, this magnet draws up a cylinder of iron constituting one of the arms of a knuckle joint, and the other arm then brings into contact two carbon disks of which one is connected to the feeder and the other to the surface plate of the contact box—the latter thus becoming active and delivering current to the shoe and motor.

In a paper on "A New Method of Charging for Electric Current," M. de Fodor, of Buda Pesth, maintained that discounts should also take in consideration the time of year. At Buda Pesth it has been found that the bills for current range from a maximum of 15.2 in December to 2.2 cents in July. As the generating station has a minimum load during the summer months, greater discounts can be given during those months than during the winter months. M. de Fodor proposes three different discounts, one applying from October to February inclusive, another during March, April, May and September, and a third from June to August inclusive. As an example, the case is taken of a consumer having 20 lamps installed and using 440 lamp-hours on an average per lamp. In January and February he would use 1200 and 1000 lamp-hours respectively, and receive a discount of 20 per cent for consumption over these figures: March, April and May, 720, 580 and 380 lamp-hours, with a discount of 40 per cent for excess; June, July and August, 240, 200 and 280 lamp-hours, with a discount of 60 per cent for excess; September, 580 lamp-hours, with 40 per cent discount, and October, November and December, 1000, 1280 and 1340 lamp-hours, with 20 per cent discount for excess.

In the discussion, already noted in our last issue, M. Lauriol said that a similar system of charging was applied at the municipal station at Les Halles, Paris—the customer paying a fixed amount with an addition proportionate to the consumption. He considered that the Wright system would give good results, but preferred a double-rate meter system. M. Fontaine said one of the advantages of the de Fodor system is that it enables consumers during the months of high discount to learn to appreciate the advantages of electric lighting. M. Mornat considered that the tariff should vary, not only with the season, but with the hour of the day.

In a paper on electric furnaces, in which the types in commercial use were briefly described, M. Keller stated that at present electric furnaces of a total capacity of 230,000 horse-power are in use, as follows: For producing calcic carbide, 185,000 horse-power; aluminum, 27,000 horse-power; copper, 11,000 horse-power, and carborundum, 2000 horse-power. In France there are calcic carbide furnaces aggregating 60,000 horse-power. In the Gin & Leleux furnaces one kw-hour produces 13.6 lbs. of calcic carbide, which corresponds to a thermal efficiency of 75 per cent. This type of furnaces belongs to a class in which the formation of an arc is avoided, and means are provided for carrying off the gases, dust, etc., engendered in operation, as well as for rapid charge and discharge. M. Keller stated that the cost of electrodes was $10 to $12 per ton of calcic carbide, on the basis of $12 per 220 lbs. of electrode. With perfected furnaces, this may be reduced to $5 per ton of carbide.

M. Popoff presented a communication on the use of telephones as wireless telegraphy receivers. The receiving apparatus consists of a battery in circuit with a conductor and coherer of oxidized steel filings. Successful experiments were made over 35 miles with masts 175 ft. high with this system. M. Vilot maintained (notwithstanding experiments showing the contrary) that the limit of wireless telegraphy is 36 miles, and that it is indispensable that the tops of the masts of the two stations shall not be invisible to each other—the curvature of the earth, he stated, being an unsurmountable obstacle to long-distance wireless telegraphy. M. Tissot disputed the above arguments, and supported the equi-potential theory of M. Blochmann, above referred to. He cited French naval experiments in which messages were transmitted over 39 sea miles with aerial conductors only 60 ft high. Oxidized filings were carefully excluded from the coherers used. M. Gavey said that he had conversed without wires between an island and a station on land 7 miles distant by the use of telephones, and he believed that electromagnetic induction in connection with telephones gives results superior to those attained with Hertzian waves, if the distance does not exceed 7 miles.

M. Chage Pacha gave an account of experiments with a microphonic system to warn fishing boats of the approach of steamers during fogs. The apparatus comprises a microphone in a closed box plunged in the water and connected with a telephone on the boat. By this means the approach of a steamer can be detected when it is three miles distant. By proper arrangements, the direction of a steamer can also be determined.

M. Semenza read a paper descriptive of the Paderno-Milan transmission plant, which employs 15,000 volts and transmits over a distance of 20 miles. The results of the operation of the plant have been so satisfactory as to place beyond question the practicability of the voltage employed. Referring to disturbances of telephone lines supported on the same poles as the transmission line, M. Semenza said that they were completely suppressed by carefully insulating the telephone line from earth. M. Hillairet stated that experiments made by the French telephone department had resulted in the same conclusion being arrived at.

M. Boucherot described a system of alternator excitation, consisting in the use of an exciter with "sinusoidal windings," which has properties the inverse of the machine excited, and giving at a certain speed a direct current when excited by an alternating current. The dynamo resembles a rotary field machine, but with an armature and commutator similar to a direct current machine, except that it has two or three sinusoidal windings instead of the ordinary direct current winding. In order that the voltage of the alternator may be independent of the load and current phase, it is necessary that the exciting current shall vary according to a certain law which is a function of the load and phase. This is realized by the combination of a compounding transformer with the alternator and exciter. Between the armature of the alternator and field of the exciter is connected the secondary of a compounding transformer, of which the primary is in the main alternator circuit.

M. Thury read a paper maintaining the advantages of direct current transmission of power over long distances. The various difficulties overcome in developing the direct current series system of transmission were referred to, and stress laid upon the fact that with direct currents trouble from inductance is avoided. A plant is sketched, employing ten double units of 1000 horse-power and of 3000 volts each, thus producing 60,000 volts and 115 amperes, which energy can be transmitted economically a distance of 120 miles.

In a paper on the luminous efficiency of incandescent lamps (carbon filaments), M. Weissmann arrives at the conclusion that 100 volts is the critical voltage in the manufacture of lamps, and at even that voltage lamps of small candle-power are inefficient. In order to use low-voltage lamps, he proposes a system which consists in installing in the houses of customers between each group of lamps and its switch, a small transformer with closed magnetic circuit to reduce the voltage to a low figure. The switch being on the primary, the transformer is out of circuit when the lamps are not lighted. The efficiency of the transformer varies from 85 per cent for one lamp to 96 per cent for five lamps, the resultant efficiency for an ordinary installation being about 92 per cent. Recent tests of low-voltage lamps employed on this system (22 volts and 16 candle-power) showed an initial consumption of 1.67 watts per candle-power, and 1.93 watts after 200 hours.

M. Zenger presented a communication describing a type of primary

battery which, he said, could be used to utilize sea water in the production of electrical energy! One electrode is formed of a porous carbon tube filled with bromine, and hermetically sealed; the other electrode consists of an iron tube pierced with holes and filled with particles of iron. The electrodes are immersed in a solution of alkaline bromides and chlorides, residues in the manufacture of sea salt. M. Zenger stated that this type of battery can be utilized on a large scale, as bromine can be procured at a low price. In criticism, M. Vignon remarked that bromine costs 20 cents per pound, and that the entire production of the world is but 300 tons.

In the discussion of a paper by Prof. Blondel on the present state of the art of wireless telegraphy, which will be referred to again in these columns, M. Blochmann stated that he had asked permission of M. Branly to bring before the congress a resolution recommending that the tube of filings, sometimes called coherer, be hereafter designated as the Branly tube; he then proceeded to read a letter from Prof. Branly asking that the subject be not broached.

In a paper entitled "Photometry," M. Violle gave a résumé of the subject from the standpoint of electric lighting, including a consideration of the action taken in 1896 at the Geneva Congress, and of the various primary and secondary standards proposed at different times. A number of criticisms of the Violle platinum standard were examined. The statement was made that this standard can be accepted as correct within 1 per cent. Concerning the proposition of Lummer and Kurlbaum to employ platinum at a temperature inferior to that of fusion, M. Violle said that the apparatus requires great skill to obtain correct results, and the light given off is too red. An objection to the use of the crater of the arc as a standard of intensity is the variation in position of the brilliant portion of the crater; nevertheless, there is hope that this difficulty may be obviated. Referring to the use of incandescent lamps as secondary standards, M. Liebenthal is cited as having shown that the mean spherical intensity of various lamps tested is equal to the mean intensity at an angle of from 46 to 53 degs. As to the Hefner standard, it is stated it cannot be considered perfect, the red tint of the flame and feeble intensity being grave defects. The pentane lamp has the advantage over the Hefner lamp of a much more satisfactory flame, but M. Violle does not consider that this makes it superior to the latter. The Methvan standard is stated to give very good results. An objection to the acetylene flame is that it often gives rise to a deposit of carbon, but M. Blondel has shown that this can be obviated by burning pure ethylene in pure oxygen. In conclusion, it is stated that there is difficulty in getting correct results with flame standards. Studies with the bolometer have shown wide variations. With the English candle variations of 46.5 per cent have been observed; 24 per cent with the German candle, 22.6 with the Hefner standard and 18.2 per cent with the Carcel lamp, though during a considerable interval of time the variation in the latter case may be less than 8 per cent. Messrs. Clayton, Sharp and Turnbull, who made the above researches, conclude that the Carcel lamp is the most constant of the standards they studied.

In an examination of the state of photometry, the superiority of the Lummer-Brodhun screen is ascribed to the great distinctness of the line of separation of the two fields, which, however, becomes less when lights of different color are compared. Several photometric apparatus proposed by Prof. Blondel were described, and also several apparatus for spectro photometry, the latter showing a notable advance through a recognition of the influence of the distribution of the light in the spectrum on the intensity of the light coming from a collimating window. The paper of Prof. Violle is an excellent résumé of the present state of the art of photometry.

M. Kempf-Hartmann presented a note on a frequency meter. The apparatus consists essentially of an electromagnet excited by the alternating current, the frequency of which is to be measured, and which acts upon a vibrating tongue. The electromagnet is moved under a number of such tongues until it finds one which gives the most distinct sound, the vibration of this corresponding to the frequency of the current. Another apparatus described was a frequency regulator, consisting of two vibrating tongues, which give forth no sound when the two circuits to which they are connected have the same frequency.

Prof. Blondin presented, in the name of Prof. Blondel, a paper giving the result of experiments on two and three-phase alternators in which the oscillograph was employed. The experiments showed that the load on one phase influences the form of curve of the other phases; that the disturbance is the greater the greater the difference of load; and that armature reaction often produces in the field circuit strong pulsations of a frequency equal to or double to the product of the induced current by the number of phases.

PARIS EXPOSITION NOTES.

THE NEW YORK ELECTRICAL SOCIETY was represented at the Paris International Electrical Congress by Dr. F. B. Crocker, Mr. C. O. Mailloux and Dr. C. A. Doremus, the two first named being past presidents and the last named being a past vice-president.

THE NEW YORK & OHIO COMPANY supplied the incandescent lamps which are placed in clusters above the façade of the United States Court of Honor in Electricity Building, and has been awarded a silver medal for the exhibit. The company also shows a 500-watt transformer, for a circuit of 60 cycles, with primary intended for 1000 or 2000 volts and secondary 100 or 200 volts, which has received a bronze medal.

BRONZE MEDALS for transformers have also been given to the Lakon Company, of Elkhart, Ind., and to the Pittsburg Transformer Company, of Pittsburg, Pa. The former company shows a 2½-kw transformer, 125 cycles, with a primary winding for 2000 volts, and secondary to give 50 or 100 volts, and the Pittsburg Company has two type K transformers suitable for either 1000 or 2000 volts on the primary side, and giving 50 or 100 volts, 125 cycles.

JAPANESE ENGINEERS.—Three distinguished Japanese gentlemen were in Paris during the latter part of August. These were H. Igarashi, a government officer; K. Oriva, government electrical engineer, and T. Tomita, examiner of the Patent Bureau. All are connected with the Japanese Legation, and have been studying the many interesting electrical features of the Exposition, including a visit to the headquarters of the ELECTRICAL WORLD AND ENGINEER.

THE C. J. TOERRING COMPANY, of Philadelphia, have a handsome row of 220-volt enclosed arc lamps in the gallery of the Suffren engine room at the Champ de Mars. These lamps give a powerful light, and are said to burn from 300 to 400 hours without renewal of carbons. The jury of Group V has awarded the Toerring Company a gold medal for the exhibit. Another winner of a gold medal is the Holophane Glass Company, of New York, who supplied the globes for the Toerring lamps, and, in addition, have a handsome display of globes of every description, constructed with the special prismatic surface, giving a maximum of light in a useful direction and avoiding the glare which a plain glass does not conceal.

PROLONGING THE AGONY.—There is much talk about the advisability or possibility of continuing the Exposition beyond the limit, Nov. 5, set for the closing. The chief agitators for extension appear to be the restaurant keepers of the Champ de Mars and the owners of so-called attractions, who say they have not had enough opportunity to make money, and believe that another month of the show would give them better profits. The trouble is due to the excessive prices for the licenses required by the authorities, which has prevented the holders from making even a small fortune; but it seems rather a curious proceeding to request exhibitors to remain a month longer in order to benefit the side shows and restaurants. The matter is under consideration by the Minister of Commerce. It will probably be decided adversely.

NIGHT FÊTES.—The success which has attended the river fêtes has led to suggestions for still further displays of this character, in which electrical effects are to be more prominent, such as electric illumination of boats and the use of searchlights upon the bridges. There has so far been little done in the way of utilizing the river as an actual part of the Exposition enclosure, yet it is bordered on both banks for a considerable distance by buildings containing exhibits, by the beautiful pavilions of foreign nations and the historical reproduction of Old Paris. On the other hand, however, there is hardly sufficient accommodation for the immense crowd which these river fêtes attract, as was sadly proven when the balustrade of a much overloaded bridge gave way under the pressure of the sightseers, fatally injuring a large number of people.

A DINNER TO DR. KENNELLY.—The Paris New York *Herald* of Aug. 27 has the following: A complimentary and farewell dinner in honor of Dr. Kennelly, of Philadelphia, was given at Paillard's on Thursday by Mr. and Mrs. C. Odilon Mailloux, of New York. In addition to Dr. Kennelly, the following guests were present: Sir William Preece, Prof. Silvanus P. Thompson, Prof. W. E. Ayrton, F.R.S., Mr. W. G. McMillan, Mrs. Thompson, Mrs. Ayrton, Professor Hospitalier, M. Leblanc, Mme. Hospitalier, Mr. Carl Hering, Philadelphia; Mr. Ralph W. Pope, Dr. F. B. Crocker, of Columbia University, New York; Mr. B. J. Arnold, of Chicago; Messrs. W. J. Hammer and H. Ward Leonard, of New York, and Mrs. Leonard. Prof. John Perry, who was expected to be present, had to return to England unexpectedly a few hours before the dinner. A conversazione on the terrace of the pavilion followed the dinner.

Electric Inclined Elevators for the Elevated Railway.

A radical and pleasing departure from the old-style method of reaching elevated railroad stations is illustrated in the accompanying engravings. They show an electric inclined elevator which has been installed at the down town station of the Manhattan Elevatvated Railroad at Fifty-ninth Street and Third Avenue by the Reno Inclined Elevator Company, of New York City.

FIG. 1.—FOOT OF INCLINED ELEVATOR.

The former stairway, which had a landing midway in the ascent, has been removed, and the straight incline shown in the photographs reproduced herewith substituted. As can be seen, it is divided longitudinally throughout its entire length, so that it can be used by both arriving and departing passengers, the two classes keeping to the right of each other in passing, as they would naturally do on a simple stairway. Ordinary steps are provided for those descending, as it was thought unnecessary to furnish an elevator for this purpose.

The speed at which the platform runs is a little over 100 ft. per minute, and it has a capacity of 3000 persons per hour. The surface of the incline consists of a series of shallow, longitudinal, rubber-covered ridges, which at the top pass between the prongs of a comb-shape landing, on which the ascending passenger is left standing if he fails to step forward when the station platform is reached. The elevator is operated by a 7½-hp C & C four-pole motor placed conveniently under the station floor, access to which is had through a trap-door. Instead of being geared to the upper drum, as was originally intended and as is shown in the cut of the side elevation, the motor is belted to the elevator. An idler pulley serves as a belt tightener. By means of a pawl resting against the inside of the platform it is impossible for the elevator to move in a reverse direction, so that should the belt slip or any other accident occur, there would be no danger of precipitating the ascending passengers to the sidewalk. It is claimed that the power used is very small when the elevator is not occupied and increases in proportion to the number of passengers being carried.

This is the first elevator of this type built by the elevated road and is proving quite a success. In the two weeks that it has been in operation it is reported that the traffic has materially increased at the station. It is understood that the road intends to place elevators at all of the principal stations and work will probably be pushed forward as rapidly as possible.

The Reno elevator has been in successful operation in many buildings both in this country and abroad, one store in Philadelphia being connected throughout its entire five floors by the system. Its installation on outdoor work is, however, something of an innovation, but present indications seem to point to satisfactory results.

FIG. 2.—INCLINED ELEVATOR.

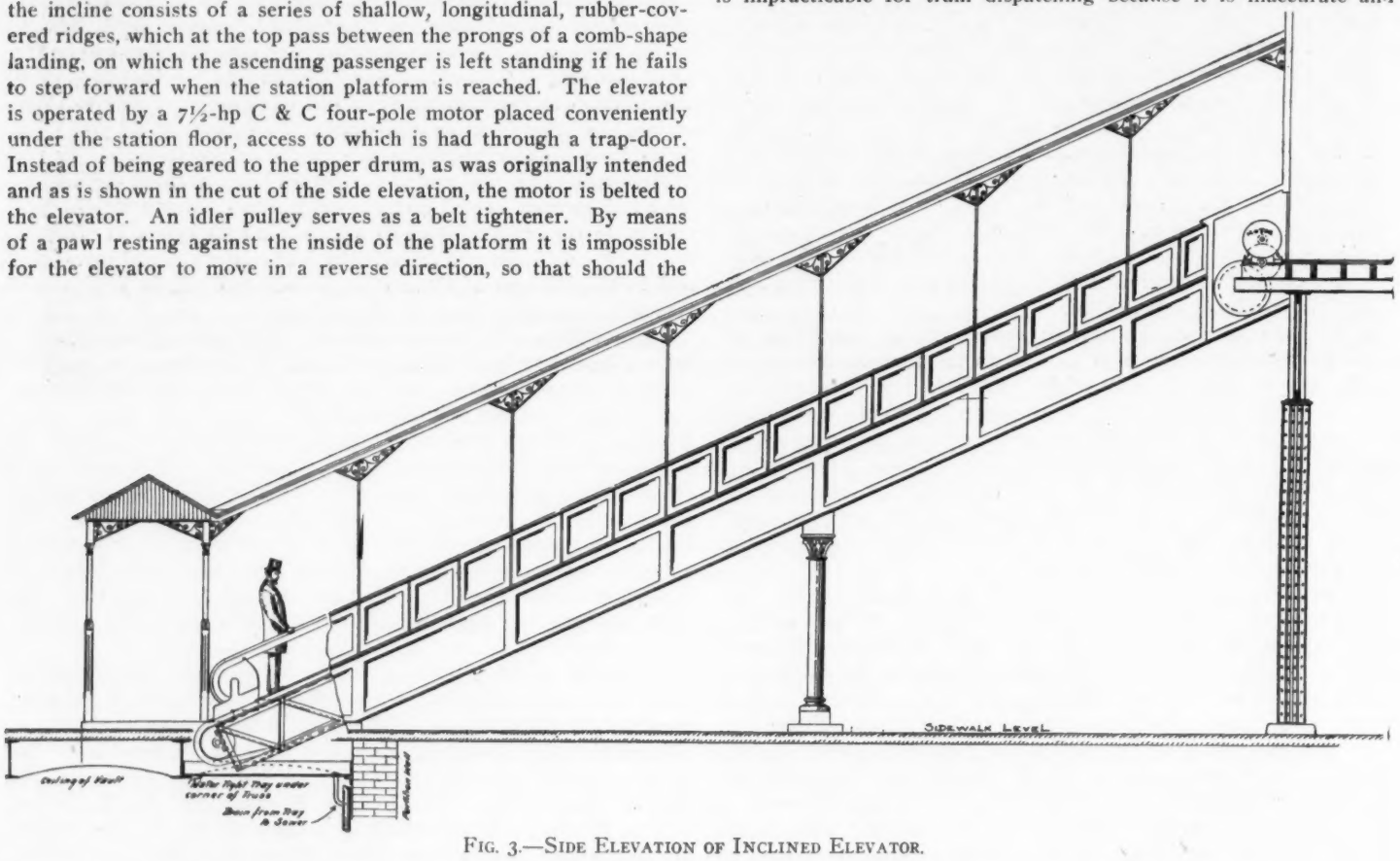


FIG. 3.—SIDE ELEVATION OF INCLINED ELEVATOR.

Telephone Not Reliable.

C. E. Yates, superintendent of telegraph for the Burlington Railway, in speaking recently of the experiments made with long distance telephones for train dispatching, said: "The telephone is impracticable for train dispatching because it is inaccurate and could not be used for anything but general business, there being no check on messages delivered. The Baltimore & Ohio and Pennsylvania Central are not using the telephone for train dispatching strictly, but only for general business. I do not think it will ever supersede the telegraph in this country—certainly not on the Burlington."

The Twenty-first Edison Convention.

The twenty-first convention (sixteenth annual meeting) of the Association of Edison Illuminating Companies was held at Saratoga Springs, N. Y., Sept. 4, 5 and 6, at the Grand Union Hotel. The convention was a pronounced success and the sessions were well attended, there being an average of 90 per cent of the delegates in attendance at all the meetings. The programme of the convention was carried out as published, the papers and discussions completely filling six long sessions.

President J. W. Lieb, Jr., in his opening address said: The object of this association, as defined in the constitution and by-laws, is: "The mutual protection of business interests and the collection and dissemination among its members of technical and business information relative to the Edison electric light system and auxiliary systems operated in connection therewith." You will thus see, at the start, from this statement of the object of the association, that there is a striking difference between our organization and kindred organizations—such as the American Institute of Electrical Engineers, the National Electric Light Association and many of the State organizations. Instead of being a purely technical body, like the American Institute of Electrical Engineers, this association, while in one sense of the word technical, has in addition important commercial interests to safeguard. One of the conditions of membership requires that its members be licensees under the Edison patents; that is, licensees of the Edison Electric Light Company, the Edison General Electric Company or the General Electric Company.

There is one striking peculiarity in our organization, and that is that companies and not individuals constitute the membership of the association. The officers are merely the representatives of the companies constituting the association. This fact, which is peculiar to our organization, has advantages and possibly some disadvantages. It is, of course, to be expected that in a body of this character, in which manifold interests are represented, and which has such a wide field of activity, the larger companies take a predominant interest. This must be the case from the connection of many of its representatives with the original Edison interests. It must also be so from the fact that the larger companies have large executive and operating staffs and, therefore, are more largely represented in the conventions and as authors of the papers that are brought before it. I think you will agree with me, however, that in the work of the association due weight has been given to the value of the membership of the smaller companies, and that every effort has been made to stimulate their interest and attendance, and I am happy to say that in this respect we have been markedly successful. The smaller companies by their attendance and active interest in the work of the association have, in turn, stimulated the larger companies in their work in its behalf.

The main work of the association is done by its standing committees. In addition to the executive committee, we have a lamp committee, one of its sub-committees; and, as standing committees of the association, a meter committee, a committee on grounding of the neutral, an automobile committee and a committee on Welsbach light and acetylene gas. As indicative of the work which the association does, and its peculiar nature and scope, I will refer briefly to the work that the lamp committee has had in hand. This feature was started originally by four of the larger companies who were buying incandescent lamps in great quantities, and who felt that it was time to institute some new method or basis of purchase, safeguarding themselves as to the quality of the product by framing an agreement incorporating a set of specifications. In order to insure compliance with the specifications a lamp testing bureau was organized, and these companies advanced a guarantee fund with which to conduct the business of testing lamps. The mutual relations of the General Electric Company and our member-companies, made it possible to prepare a tentative agreement covering the desired features, and it is impossible to see how, except through the relations which existed between the parent company and its licensees (members of this association), such an agreement could have been made. It was purely experimental in its nature, and of necessity there must have been a great deal of give and take until a mutually satisfactory basis was framed. As a result, we made a lamp agreement which was sufficiently liberal and elastic in its terms to make it acceptable, and a clause was embodied in the agreement that in case the specifications agreed upon and which defined the quality of the lamps in terms of a new unit were shown to work a hardship to either party, the specifications were to be amended at once by mutual agreement.

The meter committee has also been actively at work, and we hope

THE EDISON CONVENTION GROUP, GRAND UNION HOTEL, SARATOGA, N. Y.

that the outcome of its efforts will be of as much value to the association as the work of the lamp committee, and that the purchase of meters designed to best satisfy the requirements of our members will be facilitated by the making of an agreement containing specifications which shall be the basis of a standard product to be furnished to our members at the lowest price consistent with good membership and a reasonable profit to the manufacturer.

The automobile committee has in hand the work of recommending to the companies standard charging posts and plugs in connection with the charging of automobiles to facilitate the delivery of current to automobiles as they journey from city to city. Permit me to suggest at this time that our field of usefulness could be developed advantageously by adding to these standing committees a committee which would undertake the standardizing of switches and other electrical appliances. All of our members are purchasers in large quantities of switches of various kinds for station switchboards, service work and interior installations, and it is certainly undesirable that each company should have a standard of its own, as the conditions to be met are practically the same. In different cities the requirements of the Fire Underwriters and local authorities are usually the same, and if standard specifications could be agreed upon to enable all manufacturers to bring out standard types which could be produced in large quantities, the result would be a cheapening in the cost of production and a reduction of cost to the user.

Another subject of considerable importance we have not specifically taken up is municipal ownership, and I think it would be wise at this time to have a standing committee on that subject. Such a committee could keep in touch with the agitation that is occupying the attention of some cities, advocating municipal ownership as well as supervision and control of gas and electric works, traction enterprises, etc. Many of the smaller companies have the greatest difficulty in battling against these attempts to legislate them out of existence, and I believe that a committee of this association that would collect, tabulate and distribute information on this subject of an accurate, up-to-date character would be of distinct value and assistance to members requiring ammunition for their defense.

In the early days of the electric lighting industry the standardizing committee of the Edison interests did valuable work in the standardizing of Edison chemical meters and many Edison appliances, one of your former presidents, Dr. A. E. Kennelly, rendering valuable service in this field. Much of this early work has been of value not only to the Edison interests, but has become part of the history of the art. Many of Dr. Kennelly's investigations and experiments conducted in connection with this standardizing work have become the accepted reference data in electrical engineering work. I need only refer to his tests on the carrying capacity of wires under different conditions, cross section, insulation and environment. This association, through its member-companies and their technical staffs, has done valuable work for the industry generally; through their close relations they have been able to find useful applications for newly developed apparatus, and once found, these types have had prompt and general adoption to the material benefit of themselves and the general advantage of the electrical industry. I refer in this connection to the stimulus given to the application of storage batteries to central station service, by the pioneer work of some of the larger companies, by the interchange of experience in their use inducing others to determine each for itself the advantages which it might derive from their use. There can be no doubt that the work of the companies constituting your membership and the reports of your committees have materially contributed toward the development and improvement of what is now considered an invaluable adjunct to central station and distributing equipment. I will also refer briefly, in passing, to the influence which the members of the association have had in stimulating the manufacturers to produce new apparatus to meet new requirements as they arose, and to the influence of the individual companies in stimulating the development of such apparatus as the first examples of direct connected units, arc lamps on low tension circuits, rectifiers, phase and frequency changers, composite generators, etc. The members of this association have exerted a constant pressure upon the manufacturing companies in bringing them to realize that they must develop apparatus to satisfy new conditions and requirements, as the extension of their business developed new wants. It is unquestionably true that the manufacturing companies have in turn profited by the development of this apparatus, in being able to find at once purchasers and an outlet for their products among our companies, whose close connections enabled them to promptly appreciate the value of newly developed apparatus.

During the existence of the association, the member-companies have gradually broadened their business field. Originally confined to companies that were Edison licensees, exploiting exclusively the Edison system, most of the companies now find themselves in new relations with their former powerful and conservative competitors, the gas interests, new relations in connection with the development of transmission lines in conjunction with their distributing systems, and new relations in connection with alternating current generation and distribution, and new relations in connection with the joint operation or absorption of series arc systems. These new relations must necessarily bring us into contact with new problems, with points of view broader than simply the Edisonian, and it is, though hardly necessary to say, that contact with these new interests and the assumption of these new relations must be of great benefit to us. Take, for instance, the gas interests. For years they have been developing their business and organization, and their knowledge of the public and its requirements must be vastly superior to the knowledge possessed by those engaged in our more recently developed electrical industries. Their methods and policy have been developed on conservative lines; their usually strong financial position attests executive ability of the highest order, and we certainly must profit by closer relations with this older well established industry. They, in turn, must profit by feeling the youthful pulse of the new industry which, in spite of opposition and keenest competition, in spite of large vested interests arrayed against it, has been able to assert itself and claim a permanent position as one of the safest as well as most remunerative fields of investment. It seems to me, therefore, that these new relations, which we are daily increasing, must be mutually profitable. It is also true that the new relations with transmission systems, the various forms of distributing systems, joint operation in combination with railway systems, will enable electric companies to broaden their field of operation, and these features will all be helpful to it in enabling the supply company to generate its product at reduced cost. I know of no body of men which could so successfully handle these new demands, assimilate, cooperate with or become an adjunct to new interests and broaden the field of industrial enterprise as the men constituting the administrative and technical staffs of the companies that are members of this association. The readiness with which the Edison companies have assimilated the new systems, the fertility of resources they exhibited in combining with other systems, retaining what was best, discarding the less satisfactory features, often modifying or even entirely changing the strictly Edisonian point of view, where contact with other systems and other apparatus showed this to be of advantage in meeting the new situation—these qualities of the organization, system and equipment which the Edison companies displayed, is sufficient refutation of the statement one hears now and then, that the Edison companies are narrow-viewed, ultra-conservative and non-progressive, adhering to antiquated tradition and slow to rise to the new responsibilities.

We claim that this association can with pride assert itself to have been the pioneer in developing broad lines, and the uniform success of the Edison companies which are members of this association amply demonstrates the excellence of the lighting and power system with which we began our development, and the faithful energy with which the business has been pushed.

I would refer to the fact that the association has enjoyed the sympathy and good will of the press, notwithstanding the fact that we have supplied it with only brief reports of our convention, our business proceedings, many of the papers presented and the discussion thereon being in great measure of a confidential character. The good work we are doing, and its advantage to the industry at large, have, however, secured us the sympathy of the press—a substantial aid in the prosecution of any undertaking, in the benefits of which the public has a share.

An incident of the second session was the appointment of a special committee, composed of Messrs. Samuel Insull, Charles L. Edgar and Hoyt Post, to prepare resolutions, later to be incorporated in the minutes, expressing the great loss to the association by the death of Mr. S. Dana Greene. Mr. Insull made some very eloquent and feeling remarks on the subject.

Two notable changes were made in the committees of the association. The committee on Welsbach light and acetylene gas was discharged from further consideration of the subject, the meeting evidently being of opinion that the special interest in these subjects had ceased for the time. An additional committee was ordered appointed to be known as the committee on standardizing of switches and similar apparatus; the duty immediately assigned to this committee

being the correlation of the practice in respect of the smaller switches and cut-outs used by the member companies.

The programme of papers was as follows: "Some Notes on Electric Elevators," Arthur Williams, New York; "Systems and Apparatus for Light and Power Distribution," C. P. Steinmetz, Schenectady, N. Y.; "Polyphase Distribution," G. Semenza, Milan; "Electric Elevators and Electric Hoists," John F. Gilchrist, Chicago; "The Electrical Features of the Paris Exposition," W. C. D. Eglin, Philadelphia, Pa.; "The Year's Improvements in Meters and Measuring," C. D. Haskins, Schenectady, N. Y.; "Residence Rates in Detroit," Alex. Dow, Detroit, Mich.; "A Comparison of Arc Lighting Systems," Walter C. Fish, Lynn, Mass.; "Forty-Thousand-Volt Transmission as Part of an Ordinary Central Station System," D. L. Huntington, Spokane, Wash.; "The Past, Present and Future of the Incandescent Lamp," John W. Howell, Harrison, N. J.; "Efficiency of Electric Distribution Systems," P. Torchio, New York; "Results in the Application of the Maximum Demand Rate System," A. S. Knight, Boston, Mass.; "Twenty-five Cycles vs. Sixty Cycles for Union Lighting Stations," H. G. Stott, Buffalo, N. Y.

The papers by Messrs. Steinmetz and Howell were both admirable expositions of that branch of the art to which they were addressed in the fields of lighting and power transmission. Mr. Steinmetz devoted himself to a discussion of the alternating current. The papers on elevators contributed a good deal of data as to rates, current consumption, etc. Mr. Eglin, in his paper on the Paris Exposition, touched on the Nernst lamp, a subject in which a good many delegates showed great interest. Mr. Stott's paper was an excellent discussion of a specific problem.

The following officers were elected for the ensuing year: President, John W. Lieb, Jr., New York; vice-president, A. W. Field, Columbus, Ohio; treasurer, W. S. Barstow, Borough of Brooklyn, New York; secretary, Wilson S. Howell, Newark, N. J. Executive committee: John W. Lieb, Jr., president, chairman; Alex. Dow, Detroit, Mich.; Charles L. Edgar, Boston, Mass.; W. C. L. Eglin, Philadelphia, Pa.; Samuel Insull, Chicago, Ill.; T. E. Murray, New York, N. Y., and as ex officio members, A. W. Field, W. S. Barstow and Wilson S. Howell.

Those in official attendance were:

NEW YORK EDISON COMPANY: Thos. E. Murray, John W. Lieb, Jr., A. Williams, C. W. Rice, R. A. Cantor, P. Torchio, H. M. Edwards.

CHICAGO EDISON COMPANY: Samuel Insull, L. A. Ferguson, J. F. Gilchrist.

BOSTON EDISON COMPANY: C. L. Edgar and L. Stieringer.

PHILADELPHIA EDISON COMPANY: W. H. Johnson, W. C. D. Eglin, J. T. Maxwell, G. R. Green and J. D. Israel.

BUFFALO GENERAL ELECTRIC COMPANY: C. R. Huntley and H. G. Stott.

BALTIMORE UNITED COMPANY: G. K. Hutchins, G. F. Perin, P. O. Keilholtz and J. W. Ellard.

DETROIT EDISON COMPANY: Alex. Dow and Hoyt Post.

GRAND RAPIDS EDISON COMPANY: A. F. Walker and D. McCoy.

NEW BEDFORD EDISON COMPANY: G. R. Stetson and C. R. Price.

GENERAL ELECTRIC COMPANY: Gen. Eugene Griffin, E. W. Rice, Jr., C. P. Steinmetz, H. W. Darling, S. M. Hamill, G. E. Emmons, B. E. Sunny, E. H. Mullen, F. W. Willcox, J. R. Lovejoy, W. L. Emmet, A. L. Rohrer, W. H. Wirt, W. S. Andrews, J. W. Howell, C. D. Haskins, F. P. Cox, C. T. Hughes, G. D. Rosenthal, T. D. Boyles, H. W. Hillman, A. P. Jenks and F. M. Kimball.

Others present, or companies represented, were: W. S. Howell, secretary, and Bureau Testing Office; L. G. White and A. W. Field, Columbus, Ohio, Edison Company; H. L. Doherty, St. Paul Edison Company, W. S. Barstow, Brooklyn Edison Company; G. P. Magner, Newport, R. I., Edison Company; H. W. Darling, Des Moines Edison Company; W. F. White, Cincinnati Edison Company; H. A. Wagner, Missouri Edison Company, St. Louis; G. A. Redman, Rochester, N. Y., Electric Company; J. W. Reeves, Johnstown, Pa., Edison Company; T. G. O'Dea, Erie, Pa., Edison Company; H. T. Edgar, Brockton, Mass., Edison Company; G. W. Brine, Georgia Electric Light Company, Atlanta; C. C. Perry, Indianapolis Light & Power Company; L. H. Schercke, Edison Company, New Orleans; E. J. Bechtel, Consolidated Electric Company, Toledo; D. L. Huntington, Washington Water Power Company, Spokane; E. B. Greene, Edison Company, Altoona, Pa.; E. H. Davis, Edison Company, Williamsport, Pa.; F. M. Hoocker, Renovo, Pa., Edison Company; W. Chandler, Edison Company, Sault Ste. Marie, Mich.

CONVENTION NOTES.

DR. W. M. HABIRSHAW never misses an Edison convention, and consequently was much in evidence at this. Mr. J. P. McQuaide was also in attendance.

THE CONVENTION BADGE shown at the beginning of this report is a solid silver disk on blue ribbon stamped "Saratoga" and "1900" in silver lettering. On the face of the medal is an Edison dynamo of the later, short-field-magnet type, with the head of Mr. Edison on it, in a shield relief.

THE GROUP PORTRAIT.—We present herewith an excellent group portrait of the convention, taken just outside the meeting room at the Grand Union Hotel. The re-elected president, Mr. J. W. Lieb, Jr., is fifth from the right, and next to him on the right again sits Secretary Howell.

EXCURSIONS around Saratoga are neither numerous nor pretty, but every one went to the Lake and made a trip also to Yaddo, the charming country seat of Mr. Spencer Trask, to whose lasting credit will remain the early perception on his part of the possibilities of the Edison system. He has had his reward.

SARATOGA SPRINGS may be interesting from many points of view, but electrically it is one of the deadest places on the continent. The gas company owns the electric light plant, with the result that precious little electricity is seen. Some one ought to shake up the dry bones. Neither is there much trolley work in evidence.

MR. R. R. BOWKER was heartily welcomed by all the members of the body of which he was so admirable a president and always so useful a member. He is now immersed in civic affairs in New York, in literary pursuits and in a large publishing business, but he keeps very much au courant with the technical developments of the electric light and power art.

THE EDISON CONVENTION, while it does not grow, maintains its size remarkably. There are, of course, no additions nowadays to the ranks of Edison licensees, but the Association includes, it is said, over 60 per cent of possible members. That is a proportion that any kindred body would find it hard to equal. The National Electric Light Association falls far behind it.

MR. LUTHER STIERINGER, rather pale from long illness, and still on a pill-box diet, showed up from the Pan-American Exposition, and once again was the vigilant sergeant-at-arms. Next year the Association goes to Buffalo to see if he is maintaining his old reputation as a creator and constructor of original effects with electric light. His is work that pays for studying.

MR. THOS. H. FEAREY, at one time actively connected with the General Electric Company in New York, but now deeply engaged in lead and zinc-mining enterprises around Joplin, Mo., was an attendant at the convention, and greatly interested old friends by his accounts of the great developments and possibilities in that field. Some of his associates are leaders in electrical work.

ELECTRIC ELEVATORS furnish a leading topic nowadays in electrical circles, and Mr. C. A. Benton, general sales agent of the Marine Engine and Machine Company, was not allowed to stand idle in the market place. A great deal of interest was shown by all the delegates in this new and important venture, as a help to increasing the paying load on their circuits, particularly in the daytime.

MR. E. W. RICE, JR., recently home from Europe, looked brown and well, and as one of the vice-presidents of the General Electric Company took a prominent part in the hospitalities extended to the convention at Saratoga and Schenectady. Mr. E. H. Mullen is also just home from the Paris Exposition and with his assistant, Mr. Jenks, handled all the reception details for the company with admirable smoothness and quiet good taste. The special train to Schenectady on Friday was in the hands of Mr. Lovejoy, and proved a great success.

FLOWER CARNIVAL.—On Thursday afternoon the convention took in the annual Saratoga Flower Carnival, for which the town was beautifully decorated. One end of the Grand Union piazza was reserved for delegates and ladies, who all proceeded to throw confetti and whirl colored-paper tape as though they had been practicing it all their lives. In the evening a masked ball was given, in which again the Edisonians were by no means inactive or inconspicuous. It was somewhat of a new sensation to see an engineer supposed to care for naught but harmonics flourishing around in the garb of the Grand Turk.

A SPECIAL TRAIN provided on Friday morning by the General Electric Company took the whole convention to the great Schenectady Works. At a station en route the ladies were dropped off, bug-

gies being in attendance under the care of Secretary Darling and Mr. Willie Andrews to give them a ride through the picturesque Mohawk Valley. The men of the party were taken on to the works and escorted through. Special interest was aroused by the new switchboard department, lately organized and put in charge of Mr. C. D. Haskins. The work already requires two large floors and employs three score draftsmen, under Mr. G. U. G. Holman. Lunch served elaborately by a New York caterer followed in the office building, Mr. E. W. Rice presiding and extending hospitalities in the name of his brother officials. The menus were printed in gold on sheet mica. After lunch tasteful souvenirs, with the compliments of President Coffin, were handed around to the ladies by Mr. Rohrer, in the shape of dainty pearl and gold brooches. Those who felt they still had leisure and vigor were then taken by special conveyance to the golf links, where some wonderful playing was indulged in to the accompaniment of afternoon tea and a cool breeze. The convention then dispersed, although many delegates returned to Saratoga the same evening.

Central Battery Telephone System.

A patent relating to central battery telephone systems has been issued to W. W. Dean, of Chicago, and assigned to the Kellogg Switchboard & Supply Company, of that city. The object of it is to furnish a system whereby a common battery or source of charging-current at the central station may be connected in circuit with the telephone-line to charge the microphone or talking circuit at the sub-station, whereby the separate batteries may be dispensed with. Mr. Dean provides a plurality of telephone-lines, each having two limbs to constitute a metallic talking-circuit, each line being connected or associated at the sub-station with a third conductor, which may be the ground or other suitable conductor, and at the central station is a common battery connected with the devices there employed for uniting the telephone-lines in talking-circuit, the said source of electricity being arranged to be connected in a circuit including in series the third conductor and the two telephone-lines, whereby the source of electricity will send current over the circuit to charge the microphone-circuit. He employs in that circuit a microphone and the primary of an induction-coil, included in parallel paths of the circuit, while the secondary of the induction-coil is connected between the two limbs of the metallic circuit. The lines are united at the central station through repeating-coils, whereby each line forms a separate and distinct circuit for the talking-currents. The source of electricity will be connected between the telephone-lines at the central station and is preferably connected between the electrical centres of the windings of the repeating-coils. The current from the source of electricity may traverse the two limbs of each line in parallel; or one limb of each line may be alone employed for the passage of the charging-current. In order to prevent the variations of current upon one pair of connected lines from interfering with any other pair connected with the common source of current, a resistance is employed, preferably a reactive or impedance coil, interposed between the source of electricity and each of the connected telephone-lines. In this manner the variation of current upon any connected pair of lines is prevented from affecting

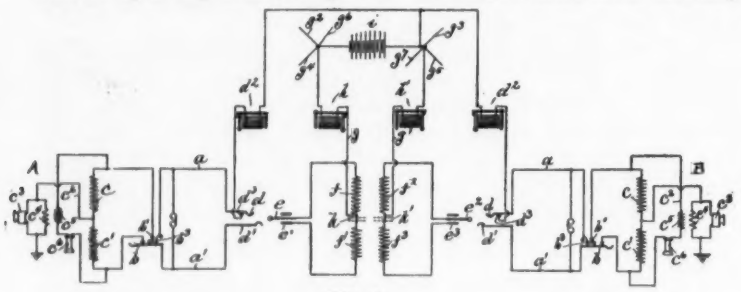


FIG. 1.

any other pair of connected telephone-lines. Fig. 1 is a diagram illustrating the invention. Fig. 2 is a diagram illustrating the manner of connecting the common battery with a plurality of pairs of telephone-lines.

The telephone-line extends in two limbs *a a'* from the sub-station to the central station, and the telephone-hook *b* is interposed in one of the limbs *a'* and is adapted to rest against a back contact when the receiver is removed from the hook, and a contact *b'*, controlled by the telephone-hook, is adapted to engage a contact b^3 to close the limb *a* during conversation. At the sub-station the limbs *a* and *a'* are connected, respectively, with the impedance and balancing coils *c* and *c'*, and from the electrical centre of these coils extends the leg c^2, in which is connected the transmitter-circuit, which in the present instance is illustrated as consisting of a microphone c^3 in one of two parallel paths and the primary c^4 of an induction-coil in the other path. The secondary c^5 of the induction-coil is connected between the limbs *a* and *a'* and also includes the receiver c^6. At the central station the limbs *a* and *a'* terminate in the line springs or contacts *d d'* of the switch-socket. The individual annunciator d^2 is connected between the contact d^3 and the pole of the charging-battery *i*, so that the insertion of the plug disconnects the individual annunciator in the usual manner. The connecting-plugs at the central station are provided with contacts *e e'* and e^2 e^3, respectively, whereby two telephone-lines may be united together for conversation. Interposed in the cord-circuit are the windings *f f'* and f^2 f^3 of the repeating-coils, and from the electrical centre of the coils *f f'* a conductor *g* extends to one pole of the battery *i* and contains the clearing-out annunciator *h*, while from the electrical centre of the windings f^2 f^3 a conductor *g'*

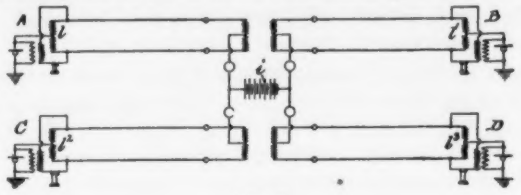


FIG. 2.

extends to the opposite pole of the battery *i* and includes the clearing-out annunciator *h'*. Similer conductors g^2 g^3 and g^4 g^5 and g^6 g^7 extend from the opposite poles of the battery *i* to other cord-connectors for joining together the telephone-lines whereby the battery *i* may be utilized for a plurality of pairs of connected telephone-lines. The apparatus and circuits of the sub-stations *A* and *B* are similar and have been indicated by the corresponding reference-letters. The apparatus for sending signals from the central station to the sub-station may be of any of the usual forms and for clearness has been omitted.

In the diagrams are illustrated in dotted lines condensers *k k'*, inserted in the windings of the repeating-coils at the central station in order that the charging-current from the battery *i* may traverse only one of the two limbs of the metallic talking-circuit. When it is desired to utilize both limbs of the talking-circuit for the charging-current, the condensers may be omitted.

When subscriber *A* is desirous of conversation, he removes his telephone-receiver from the hook *b*, thus closing the metallic limbs and closes the circuit from ground at the sub-station through the microphone-circuit, conductor c^2, limb *a*, contact d^3, annunciator d^2, and battery *i* to ground, which will be provided by any telephone-lines which are connected for conversation and which are in circuit with the battery *i*. Since more or less of the telephone-lines are continuously in circuit, the ground thus produced may be relied upon for calling-currents. Other methods of signaling the central station may, however, be employed when desired. The operator inserts the calling-plug in the socket of subscriber *A* and inserts the opposite plug of the pair in the socket of subscriber *B*, and after subscriber *B* responds and removes his telephone from its hook the two subscribers are connected together for conversation. As thus connected, the circuit of battery *i* may be traced from ground at sub-station *A* through conductor c^2, limb *a*, spring *d*, sleeve *e*, coil *f*, annunciator *h*, battery *i*, annunciator *h'*, coil f^3, and thence over limb *a* of subscriber *B* to ground. The charging-battery *i* is thus connected in series with the two connected telephone-lines and serves to charge the microphone-circuit of the two subscribers. The variations of the resistance of the microphone at either sub-station cause a varying current to flow through the primary of the induction-coil there, which induces a current in the secondary coil. Thus the induced current through the coil c^5 at sub-station *A* passes over limb *a*, windings *f f'* to the repeating-coil at the central station, and back over limb *b*, thereby inducing currents in windings f^2 f^3, which pass over the limbs *a* and *b* of telephone-line *B* and over receiver c^6 thereat. Thus the talking-currents are propagated over the two metallic limbs of the telephone-line, while the charging-current passes over the two telephone-lines in series and returns through ground or other common return. When the subscribers are through conversation, the hanging up of the telephone-receiver opens the limb *a*, and thereby stops the flow of current through annunciator *h*, which causes a signal to indicate that the subscribers desire disconnection.

The clearing-out annunciators *h h'* have sufficient retardation or

impedance to prevent the fluctuation of current in any pair of connected telephone lines from affecting any other pair of connected lines. Instead of employing the coils of clearing-out annunciators for this purpose separate impedance coils may be provided, if desired.

In Fig. 2 four subscribers' lines, *A*, *B*, *C* and *D*, are illustrated, the lines *A B* being connected together to form one pair of connected lines, while the lines *C* and *D* are connected together to form another pair of connected lines. It will be noted that the common battery *i* is arranged to supply charging current to the two pairs of connected lines and the two pairs are in parallel with each other. Likewise any greater number of pairs of connected lines may be connected in circuit with the same battery, and the circuit arrangements and the presence of the impedance coils $h\ h'\ h^2\ h^3$ prevents the currents of one pair of lines from interfering with those of another. It will be observed that a plurality of cord connectors are associated with a common battery, one terminal of each cord connector being joined to one pole of the battery, while the other terminal of the cord connector is joined to the other pole of the battery.

Telephone Trunk Circuit.

A patent which has just been issued to D. S. Hulfish, of Chicago, and assigned to the American Bell Telephone Company, provides a trunk circuit with one visual signal located at the switching-plug terminal which is adapted to automatically operate, first, as a connection signal when a connection plug is inserted in the spring socket terminal of the circuit, and, second, to automatically operate as a disconnection signal upon the removal of said connection plug from said spring socket. The invention provides means to automatically give and remove the busy-test condition to and from the operator's telephone at the switching plug terminal. In carrying out the invention means (as a plug connector) are provided, when a call is made for a station which necessitates the use of a trunk circuit for connecting the calling circuit with the switch socket of the trunk circuit, which causes a lamp signal to be lighted at the opposite or plug end of the said circuit to attract the attention of the switching operator there, who, after taking the call over an order circuit, inserts the plug terminal connector of the trunk circuit into the switch socket of the called-for circuit. The insertion of the plug connector into the switch socket of the called-for circuit operates to efface or extinguish the lamp signal, and upon the termination of the use of the circuit thus organized and the withdrawal of the plug connector from the trunk circuit switch socket the same lamp signal is again lighted or displayed to indicate to the switching operator this time that a disconnection is desired. When the switching operator is notified of the circuit wanted over the order circuit she proceeds to make a test to ascertain whether the circuit is in use or not, which is done in the usual manner, and at this stage of the circuit arrangement her telephone is in circuit with the tip of the trunk plug; but when said plug is inserted in the switch socket of the called-for circuit the telephone is automatically switched out of circuit.

Referring to the diagram which illustrates the invention, *L* is a trunk circuit extending between the telephone stations *X* and *Y*, and *P* at the former station represents one of a pair of switch plugs *A* employed for connecting two circuits together, of which 1 and 2 are conductor cords connected, respectively, to the front sleeve contact surface b^2 and to the tip contact surface a^2, the rear contact surface c^2 being grounded by the wire 3.

The trunk circuit *L* consists of three conductors, 4, 5 and 6, joined at station *A* to the springs *a b* and the test ring *c*, respectively, of the spring socket *J*. While at the station *Y* the conductor 4 terminates at the front contact surface a^4 of the plug P^2, the conductor 5 extends to the tip contact surface b^4 of said plug, while the conductor 6 is grounded through the windings of relay *R* and battery *B*. The rear sleeve contact surface c^4 of said plug is grounded through the conductor 8, the windings of relay R^2 and battery *B*. The relay R^2 is provided with armatures *f* and *g*, one at each end of the core, the rear contact 10 of the armature *f* is connected to point *h* on conductor 6 by the wire 7. and the conductor 17 connects the said armature with point *k* on the conductor 8 and includes in its circuit the visual lamp signal *S*, and the rear contact 16 of armature *g* connects with conductor 5 at the point *i* by means of the conductor 9, while the armature is grounded through the operator's telephone *T* by the conductor 15. L^2 represents a sub-station or other circuit provided with one or more switch sockets J^2, adapted to be connected by the plug P^2 to the trunk circuit *L*, and its conductors are at the socket J^2 provided with the normally-open contact springs a^2 and b^2 and the test ring c^2, grounded by the conductor 18 through the resistance *r*.

In the operation of the invention, the operator at station *A*, having received a call requiring connection with a sub-station circuit beyond her reach or with one whose terminal switch socket is not upon her switchboard section, but which is located upon the switchboard section of the switching operator at switchboard or station *Y*, and having upon her section the switch socket *J* of the trunk circuit *L*, which may be multiplied to other operators' switchboard sections, proceeds to insert the calling plug *P* of a pair of switching cords and plugs into the switch socket *J*, its conductors 1 and 2 making connection with conductors 4 and 5, respectively, and the rear contact surface c^2 completing a circuit with the test ring *c*, and current flows from battery *B*, conductors 14 and 17, lamp signal *S*, armature *f* of relay R^2, conductors 7, 6 and 3 to grounds *G* and G^2, and the lamp signal is lighted. At the same time current flows from battery *B*, conductor 6, and winding of relay *R* to ground *G*, energizing the relay and causing the attraction of armature *e*, which remains attracted while the plug *P* is in the socket *J*. The switching operator at *Y* in response to the signal listens into an order circuit (not shown) and receiving the call for connection of trunk circuit with sub-station circuit L^2 first touches the tip of plug P^2 to the test ring c^3 of switch socket J^2, and a circuit is completed from ground G^3, conductor 15, telephone *T*, armature *g* of relay R^2, conductors 9 and 5, tip b^4 of plug P^2, test ring c^3, conductor 18, and resistance *r* to ground G^4, and if there is no connection at another switching switchboard section there will be no click in the telephone, and conversely, whereupon she pushes the plug into the switch socket, and the conductors 4 and 5 are in electrical circuit with the conductors of the circuit L^2, and the rear contact surface joining the test ring c^3 completes a circuit from battery *B*, conductor 8, winding of relay R^2, conductor 18 to grounds G^4 and G^2, and the relay is energized and attracts its armatures *f* and *g* from their back or resting contacts 10 and and 16, and an unobstructed talking circuit is provided between sections *X* and *Y*. The plug *P* at the termination of conversation is with-

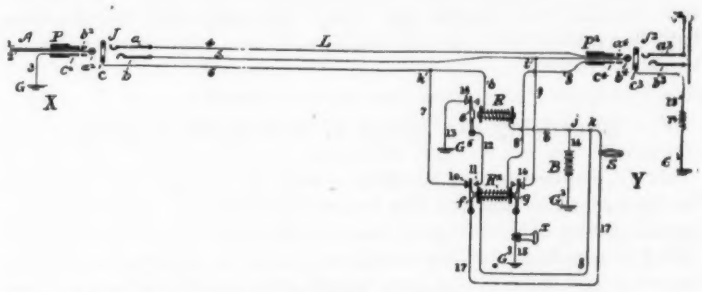


DIAGRAM OF TELEPHONE TRUNK CIRCUIT AND CONNECTIONS.

drawn from the switch socket *J*, thereby opening the circuit through relay *R* and battery, and the armature *e* falls upon its resting contact 14 and a circuit is completed from battery *B*, conductor 17, lamp signal *S*, armature *f* of relay R^2, its forward contact 11, conductor 12, armature *e*, and conductor 13 to ground G^5, and the lamp signal lights to indicate to the switching operator a disconnection, and she then withdraws the plug P^2 from the switch socket J^2 and the circuits resume their normal condition. There will be no confusion in the mind of the operator when the lamp is lighted as to whether it is for a connection or disconnection signal, as she will be aware of the position of the plug P^2 whether it is upon the keyboard or within a switch socket J^2.

The relative proportions of the apparatus employed depend largely upon the potential of the battery *B*. If a 4-volt battery is used, the signal *S* would be a 4-volt lamp of such resistance and candle-power as to give a satisfactory signal, there being no resistance in series with it, or should an electromagnetic signal be used it may be of such resistance as to operate upon the full voltage of the battery, and with such a battery the relay *R* may be of 40 ohms resistance and that of relay R^2 about 10 ohms, and the resistance coil *r* is arranged for the sub-station circuit L^2. It therefore forms no part of the proportions of the invention, but varies from 30 to 35 ohms, according to the special kind of circuit, and therefore accords very well with the dimensions herein given for the trunk circuit.

Telephone Line Protector.

The object of an invention patented to C. H. Arnold, of Boston, and assigned to the American Bell Telephone Company, is to reduce the potential of the line conductors to approximately that of the earth, and thereby to remedy these and other harmful results incident to the presence of excessive potentials on telephone-circuits, or, in other words, it is to provide a simple means for clearing the line conductors of these intrusive and detrimental charges without at the same time diminishing the volume of the legitimate working current or involving any material escape thereof. The metallic-circuit is provided at one or more points between its end stations with an electromagnetic coil or helix wound on a normally unmagnetized single or homogeneous iron core, preferably of the closed magnetic-circuit type, in such a way that if a direct current be passed from one of its ends to the other a magnetizing effect on the said core will be exercised. The coil is connected in a bridge of the metallic telephone-circuit extending between and uniting the two conductors, and a resistanceless earth conductor is attached to its centre, thus providing a dead ground conductor connection at the middle of the coil. The device as a whole when thus connected constitutes a leak from both lines at the same point to earth, the discharge of each conductor passing by way of its own half of the winding, while with respect to the said conductors considered as the two sides of the telephone-circuit it constitutes merely a bridge containing the whole of the electromagnetic winding, the ground connection from this point of view being functionless. The intrusive charge passing from both conductors simultaneously traverses the two halves of the coil in opposite directions and discharges to earth at the middle thereof, acting to maintain absolute magnetic neutrality in the normally unmagnetized core; but the voice-currents or other legitimate working currents of the telephone cannot pass from one side of the circuit to the other through the discharging device without traversing the whole of the winding around the core at any given moment in the same direction, thus tending to set up *N* polarity at one end of the normally unmagnetized core and *S* polarity at the other end and therefore producing a maximum impedance to the passage of the voice or working currents. Hence, the said device while having a low impedance to the detrimental charges infesting the line has a high impedance as regards the working current, so that while the passage of the said undesired charges from both line conductors is greatly facilitated there is no material loss of working current.

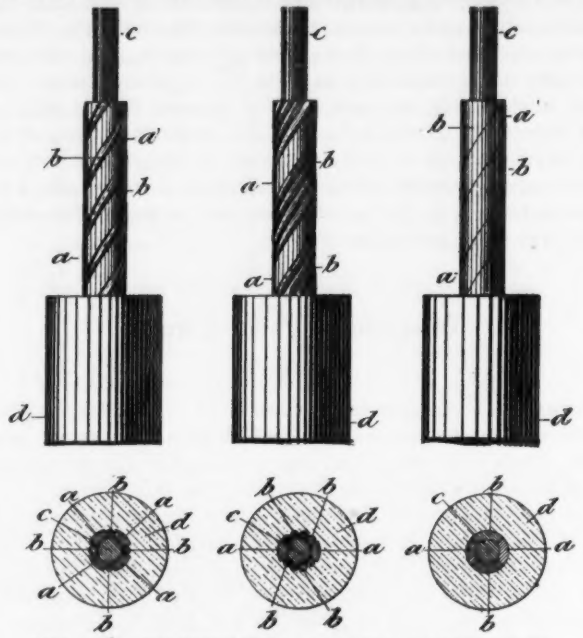
Improving the Speed of Submarine Cables.

Mr. T. Guilleaume, of Mulheim-on-the-Rhine, has been patenting in Germany, England and this country an improved method of constructing long cables, so as to lessen their capacity and increase their speed of working. In long submarine cables the speed of working is seriously restricted by the great electrostatic capacity of india-rubber and gutta-percha. With a view to reducing the capacity when the conductor is of the "built-up" type it has been proposed to employ outer wires which are either flat or are shaped as segments of an annulus, so as to render the external surface of the conductor smooth. In order to still further reduce the capacity, the self-induction of the conductor is, according to the present invention, increased. This is accomplished by laying up around the central wire or core a number of wires composed of iron or other magnetic metal or a number of such wires arranged alternately or otherwise grouped with copper wires. In either case the outer wires, whether of copper, iron or other magnetic metal, may be flat in form or may be shaped as segments of an annulus, so as to impart a smooth outer surface to the compound conductor, or some of the outer wires may be cylindrical and others segmental in cross-section, while the core, instead of consisting of a single wire, may be composed of a number of small copper wires laid up about a central wire of copper or other metal of high conductivity.

Fig. 1 is a side elevation, and Fig. 2 a transverse section, of a cable in which a number of "shaped" and cylindrical wires of copper and iron, respectively, are laid up alternately around a cylindrical core-wire. Fig. 3 is an elevation, and Fig. 4 a transverse section of a cable in which a number of cylindrical wires of iron disposed between shaped wires of copper are laid up around a cylindrical core-wire. Fig. 5 is an elevation, and Fig. 6 a transverse section of a cable wherein both the copper and the iron conducting-wires constituting the outer group are of the shaped type before referred to.

In the constructions shown in Figs. 1 to 4, *a a* are the shaped wires of copper, and *b b* the cylindrical wires of iron. In Figs. 1 and 2 these wires are laid up alternately around the core-wire *c*, and the whole is enclosed within the insulating-covering *d*, while in Figs. 3 and 4 several cylindrical iron wires *b b b b* are disposed between the shaped copper wires *a a*, laid up around the core-wire *c*, and then enclosed in a covering *d* of insulating material.

According to the construction illustrated in Figs. 5 and 6 shaped



FIGS 1-6.—IMPROVEMENTS IN CABLE MANUFACTURE.

wires *a a* of copper and shaped wires *b b* of iron, arranged alternately, are laid up around a core-wire *c*, a smooth outer surface being thereby imparted to the conductor. The wires laid up around the core-wire may be wholly of iron, or there may be laid up around the core-wire first a number of wires of copper or other high-conducting metal or alloy and around these a number of wires of iron or other magnetic metal.

CURRENT NEWS AND NOTES.

NEW CHINESE CABLE.—The Western Union Telegraph Company announces that a new cable between Port Arthur and Chefoo, China, was opened by the Great Northern Company on Sept. 6.

THE AUTOMOBILE CLUB OF AMERICA has just issued its first annual club-book, containing not only a list of members and standing committees, but a lot of useful road and power data.

MACHINE WAR HORSES.—The fall manœuvres of the French army began last week. A unique feature is the many uses to which the automobile is put. The generals have discarded their chargers and are using automobiles exclusively.

ELECTRICAL PORTRAITURE.—Our Italian contemporary, *L'Electricita*, of Milan, is publishing an album of electrical worthies. It will contain 200 portraits. The price is one dollar, with 10 cents for registration. We understand it to be international in scope.

ELECTRICITY FROM COAL.—Mr. Edison says, in reference to the newspaper report to the effect that he had invented a new machine for the generation of electricity directly from coal without the intervention of engine, boiler or dynamo, with a prediction that it would revolutionize the world in electrical matters, "It is a lie and a fake. There is not a word of truth in it from beginning to end."

BLINDING SEARCHLIGHT.—A special despatch from Newport, R. I., a few days ago, says: "A test was made this evening with the searchlight of the torpedo station upon the crews of the torpedo boats Morris, Craven and Rodgers. The searchlight was constantly thrown on the crews, and its effect was so great that not one of the members of the three crews was able to assist in working his boat; in fact, the men reported on their return that they were completely blinded and helpless while the light was on them, and for some time after its

removal they were unable to work their boats." No mention is made of the use of blue or smoked glasses to tone down the light.

NATIONAL MUNICIPAL LEAGUE.—Among the papers to be read at the eighth annual Conference for Good City Government and the sixth annual meeting of the National Municipal League, to be held in Milwaukee on Sept. 19, 20 and 21, is one entitled "Local Transportation and Its Relation to the Welfare of the Municipality," by Mr. George E. Hooker, of Chicago. The programme for the meeting is an extensive one and embraces several papers of special interest to municipal officials. A paper on "Municipal Accounting" will be read by Mr. M. N. Baker, of New York City, and will be discussed by Mr. Jas. B. Cahoon, of Syracuse, president of the National Electric Light Association.

CONVENTION OF MUNICIPAL ELECTRICIANS.—All the arrangements for the convention of the International Association of Municipal Electricians have now been completed by Mr. Morris W. Mead, the chairman of the executive committee, and it is anticipated that the meeting, which will be held in Pittsburg on Sept. 25, 26 and 27, will be a very successful gathering. The Central Passenger Association has granted the association a special rate of a fare and a third on the certificate plan. Mr. Mead reports that outside of the fact that all the large cities of this country will be represented at the convention, he has also received the assurance from foreign countries that many delegates from abroad will attend.

NEW YORK STREET RAILWAY ASSOCIATION.—The eighteenth annual meeting of the Street Railway Association of the State of New York will be held at the Iroquois Hotel, Buffalo, N. Y., Sept. 18 and 19. The first business meeting will be held at 9:30 a. m., Sept. 18, after which the party will visit the Pan-American Exposition grounds, and inspect one of the transformer stations and storage battery plants of the Buffalo Railroad Company. At 8 p. m. the annual dinner of the association will take place. The final business meeting will be held on the morning of Sept. 19, and the party will afterwards proceed to Niagara Falls by special cars. At the Falls they will inspect the power house of the Niagara Falls Power Company, and will afterwards visit several points of interest on the Canadian side.

POWER IN MEXICO.—The work of constructing one of the most extensive power plants in the republic is now in progress in the State Chihuahua, located on the San Juan branch of the Concho River. The company was incorporated several months ago in Illinois, with a capital stock of $1,000,000, gold, a former United States consul at Chihuahua being the promoter. The undertaking includes the construction of a dam in the river named between the city of Peral and Chihuahua. This dam is to be 250 ft. wide and 150 ft. in height, which, it is believed, will form a lake in the valley 15 miles long with an extreme width of 3½ miles. The power generated by the waters of this lake will be transmitted to Peral, 40 miles away, and to Chihuahua, 80 miles distant. The system is so planned that cables can be run from the main lines in any direction, and whatever amount of power is desired can be delivered at a reasonable cost. From 6000 horse-power to 10,000 horse-power has already been contracted for in the two cities directly interested.

THE AMERICAN STREET RAILWAY ASSOCIATION.—The nineteenth annual meeting of the American Street Railway Association will be held at Convention Hall, Kansas City, Mo., Oct. 16, 17, 18 and 19. Papers will be read on the following subjects: "Double Truck Cars; How to Equip Them to Obtain Maximum Efficiency Under Varying Conditions;" "Comparisons of the Various Systems of Electrical Distribution for Street Railways;" Consolidation of Street Railways and Its Effect upon the Public;" "The Store Room and Store Room Accounts;" "Painting, Repainting and Maintenance of Car Bodies." It is expected that there will be a large exhibition of street railway supplies. The annual banquet will be held at the Coates House on the evening of Oct. 18, when the officers-elect will be installed. The headquarters of the Association will be at the Midland Hotel. The Passenger Associations have granted a rate of one and one-third fare, on the certificate plan, provided 100 or more tickets are purchased.

ALCOHOL PLOW LOCOMOBILES IN GERMANY.—Consul-General Guenther sends the following from Frankfort: On July 25 the motor factory of Oberursel, near Frankfort, exhibited in the presence of a number of experts its new alcohol plow locomobiles. The plow locomobile is 20 horse-power, and confidence is expressed by competent judges that coal can in some cases be substituted by alcohol, which can be procured everywhere and at a low cost. The alcohol plow is said to have performed its work fully as well as a steam plow operated simultaneously. The problem of using alcohol for power purposes has been solved by the motor factory in evaporating denaturized alcohol of 90 degs. The construction and operation of the motor is, after this gasification, the same as that of a gas motor. The machine uses about a pint of alcohol an hour for 1 horse-power. It is claimed that the operating expense is 25 per cent lower than that of steam plows.

"RAPID TRANSIT."—Mr. Harry C. Du Val, of the New York Central, who is interested in electric street railroads, and who returned from Europe last week, does not entertain a very high opinion of the way in which rapid transit is managed on the other side. "I inspected and went over the systems in Paris and in London," he said, "and found much there that was of interest. The road in Paris has only been in operation a few months. They have different ways of running things over there which would not go here. In Paris the cars seat 36 persons, and there is standing room in each for eight. When this number have entered a car, the gates are closed, and the crowd on the platform is forced to wait for the next car. Then there is another rush, and when the 44 persons are in, the car starts and there is another wait. If those officials had to handle a 6 o'clock crowd at the Brooklyn Bridge entrance, they would hand in their resignations in 24 hours or end up in a madhouse. Many Americans who have been on the underground road, and had to wait for a car, have given up riding on the line and are content to ride on the busses. The American crowd would not tolerate the system of waiting for a car to come along with less than 44 on it before they could get aboard. I do not think that the Paris system is a very great success. In London you have to go down many feet to the tracks, and then there is the same wait for a car that there is in Paris. In both cities there are sometimes 1000 persons at a station waiting for a chance to get a car."

LETTERS TO THE EDITORS.

Current and the Wire.

To the Editors of Electrical World and Engineer:

Sirs:—Having only recently obtained a copy of the second edition of Dr. Louis Bell's book on "Electric Power Transmission," his remarks in the first chapter thereof concerning the familiar phenomenon of "the skin effect" have just come to my notice.

Beginning at the bottom of page 6 and continuing on page 7, Dr. Bell, after having in the previous pages shown that "electrical energy" is "radiant energy," draws the conclusion expressed on page 7: "We are thus forced to the conclusion that when an electrical current, as we say, passes along a wire, * * * it is not simply passed along from molecule to molecule in the wire, as sound or heat would be, but that there is an immensely rapid transfer of energy in the neighboring ether, that reaches all points of the wire almost simultaneously. It takes a measurable time for the electrical energy to reach and utilize the centre of the wire, although its progress over the surface, thanks to the free ether outside, is enormously rapid." I for one cannot agree with this conclusion.

First, for the reason that if the electrical energy were to move with less restriction in the "free ether" around ("outside") the wire, it would be manifest in all directions equally, for the ether is said to "pervade all space." And if the wire offered relatively higher resistance to the flow of electrical energy, than the ether did, then by the natural law, the energy would be more readily transmitted through the ether than through the wire, and we should be working with conclusions diametrically opposed to the known fact that electrical energy seems to pass along a wire.

Second, unless we assume that ether and air occupy the same space, or are mixed together, we must relegate ether to space outside of the earth's atmosphere. In fact, this we must do unless we say also that ether occupies the same space and is mixed with the copper. If "ether pervades all space," then it pervades the space occupied by the copper wire as well as that occupied by the air, and it becomes absurd to treat the wire as surrounded by "free ether."

Third, there occurs to the writer hereof an explanation of the phenomenon quite logical. Physicists tell us that relatively to each other

and to their own size, the atoms which go to make up any substance are as far apart as the planets of our solar system. Then let us suppose our solar system to be a mass of copper, and some relatively large individual should want to make wire of it. He would draw it through an immense die, and the result would be what is relatively true of the copper wire, the planets constituting the outer surface of the wire are relatively much more closely related than those near the centre and the ether of air-gaps thereabout are much shorter. Now if the electrical energy follows the wire at all it must be because the copper of the wire furnishes a more ready path than the ether or atmosphere (not synonyms), and it is only natural to suppose that this being so, and my supposition above being true. the electrical energy will follow the surface of the wire, and naturally such a condition would appear more prominently with alternating currents than with direct currents.

Some may ask, can this condition be demonstrated, and my answer would be that it might possibly be shown by a careful test, as between cast wire and drawn wire, though it would be manifest that in some degree the limits of the mould used for casting would tend to compress the atoms more nearly together at the surface.

To make the test with a drawn copper tube would not give a correct result as compared with a drawn wire, for the drawing effect, and whatever advantage it brings, takes place both on the inside and the outside, thus doubling the effect simply drawing the wire. It might be expected that the more processes of drawing the wire is put to, the more greatly enhanced would be its carrying capacity per square inch of cross section, and tests may show this to be the case, though there may probably be a limit in the neighborhood of the second drawing, because what ability we have to compress the atoms more nearly together is utilized with the first, or certainly with the second process of drawing. A test on a wire made by forcing through a die from behind instead of drawing through might develop interesting data also.

FREDERIC W. DARLINGTON.

[Dr. Bell has been shown this letter, and states that he has nothing to say in reply.—EDS. E. W. AND E.]

The Design of Tractive Electromagnets.

To the Editors of Electrical World and Engineer:

Sirs:—In the issue of July 28 of the ELECTRICAL WORLD AND ENGINEER there appeared an article on "The Design of Tractive Electro-Magnets," by Prof. W. E. Goldsborough. To certain statements made and results obtained by him in this article, I beg to take exception.

On page 127, he states that by doubling the area of the pole face, the travel of the plunger (and necessarily the working air-gap) may be increased four times. This presumably with a constant magneto-motive force, and keeping either the initial *pull* or the *work* constant.

That this is not true in either case, is shown as follows:

If P = Pull in pounds.
L = Length of plunger travel in cms.
B = Number of lines of force per sq. cm.
ϕ = Constant 11,183,500.
A = Area of pole faces in sq. cms.

$$P = \frac{B^2 \times A}{\phi} \qquad B = \sqrt{\frac{\phi \times P}{A}}$$

$$M.\,M.\,F. = B \times L; \qquad L = \frac{M.\,M.\,F.}{B} = \frac{M.\,M.\,F.}{\sqrt{\frac{\phi \times P}{A}}}$$

$$= \frac{M.\,M.\,F.}{\sqrt{\phi \times p}} \times \sqrt{A}. \qquad \text{If } A \text{ be made} = 2A\text{; then}$$

$$L = \frac{M.\,M.\,F.}{\sqrt{\phi \times p}} \times \sqrt{2A}$$

or doubling the area increases the length of pull $\sqrt{2}$ times and not four times; the *initial pull* and the m. m. f. remaining constant.

If the increase in length of pull is for constant m. m. f. and *work*, this increase for double the area can be only twice as great as before. This is shown by the fact that W varies directly with P and L, while P varies directly with A, and inversely as $(L)^2$. Doubling A, therefore, would make $P = 2p$. Doubling L would reduce $2P$ to

$$\left(\frac{2p}{4}\right) = 1/2p. \qquad 1/2p \times 2L = p \times L.$$

With reference to the results he obtains in increasing the polar area by making the pole face conical, and at the same time getting a long plunger travel with a short air-gap, he does not consider the fact that the magnetic stress is perpendicular to the pole faces, and the force exerted thereby is *not* along the axis of the plunger, tending to draw it up. The only force we have in this case which is effective is the component, parallel with the plunger axis, and by referring to Fig. 2 this is seen to be equal to $P \times \cos \psi$. Therefore, for magnets with conical pole faces the usual formula does not hold unless used with a proportionality factor.

The following will probably make this clear and also show the relations between initial pull and travel of plunger, when a given magnet has its polar area increased by shaping the pole faces conically. In this discussion the air-gap *only* is considered, as the m. m. f. required in other portions of the circuit are very small as compared with the m. m. f. of the air-gap.

Let P = Total pull.
p = Effective pull.
L = Working air-gap.
T = Travel of plunger.
B = Number of lines of force per sq. cm.
A = Area of pole faces in sq. cms.
ϕ = Constant 11,183,500.
ψ = Angle made by surface of pole face with plane, at right angles to axis of plunger.

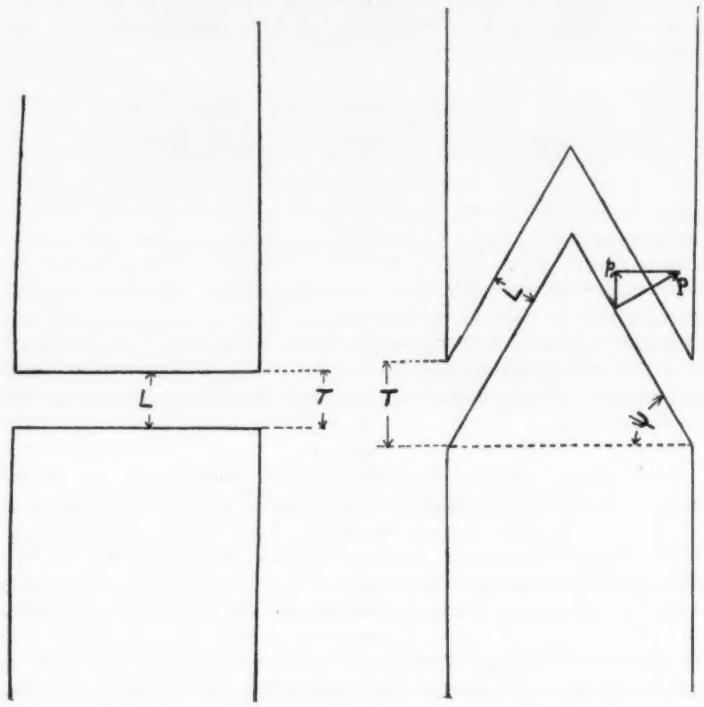


FIG. 1. FIG. 2.

Referring to Fig. 1, it will be seen that where the pole faces are flat, opposite, parallel and with coincident axes

$$\left.\begin{matrix} T = L \\ \psi = O \\ b = P \end{matrix}\right\} \text{ and the equation } P = \frac{B^2 \times A}{\phi} \quad (1) \text{ holds.}$$

In the case of conical pole faces, however, as shown in Fig. 2—

$$T = \frac{L}{\cos \psi} \qquad (2)$$

$$p = P \cos \psi \qquad (3)$$

Therefore a general formula for the effective pull p of any magnet would be—

$$p = \frac{B^2 \times A \times \cos \psi}{\phi} \qquad (4)$$

For m. m. f. of air-gap for given travel of plunger T,

$$M.\,M.\,F. = B \times L = B \times T \cos \psi \qquad (5)$$

and for B with given travel T,

$$B = \frac{M.\,M.\,F.}{T \cos.\ \psi} = \sqrt{\frac{\phi \times p}{A \cos.\ \psi}} \qquad (6)$$

also,

$$M.\,M.\,F. = \sqrt{\frac{\phi \times p}{A \cos.\ \psi}} \times T \cos \psi \qquad (7)$$

In case of flat-faced magnets—

$$\psi = 0$$
$$\cos \psi = 1$$

Substituting in Eq. (4) the value of B in Eq. (6)

$$\left(= \frac{M.\,M.\,F.}{T \cos.\ \psi}\right)$$

we get

$$p = \left(\frac{M.\,M.\,F.}{T \cos.\ \psi}\right)^2 \times \frac{A \cos.\ \psi}{\phi} \qquad (8)$$

or in flat-faced magnets

$$p = \frac{(M.\,M.\,F.)^2}{T^2} \times \frac{A}{\phi} \qquad (9)$$

If now we maintain the same m. m. f. and keep the diameter of the plunger constant; by making the pole faces conical, the elements of the cone making an angle of 60° with its base ($\psi = 60$) we find that the area of the pole faces is doubled, or A = new area = $2A$.

$$\psi = 60$$
$$\cos.\ \psi = 0.5$$

Substituting these values in Eq. (8) we get

$$p = \frac{(M.\,M.\,F.)^2}{(T \times 0.5)^2} \times \frac{2A \times 0.5}{\phi} \qquad (10)$$

$$= \frac{(M.\,M.\,F.)^2}{T^2 \times 0.25} \times \frac{A}{\phi} \qquad (11)$$

or p in (11) is four times the value of p in (9) or the initial pull is quadrupled with same *plunger travel* and m. m. f.

If we desire to increase the travel of plunger, maintaining the same m. m. f. and initial pull, the following equations result:

From Eq. (8) we get

$$(T \cos \psi)^2 = \frac{(M.\,M.\,F.)^2 \times A \cos.\ \psi}{p \times \phi} \qquad (12)$$

$$T = \sqrt{\frac{(M.\,M.\,F.)^2 \times A \cos.\ \psi}{p \times \phi \times (\cos.\ \psi)^2}} \qquad (13)$$

$$= \sqrt{\frac{(M.\,M.\,F.)^2 \times A}{p \times \phi \cos \psi}} \qquad (14)$$

For flat-faced poles this reduces to

$$T = \sqrt{\frac{(M.\,M.\,F)^2 \times A}{p \times \phi}} \qquad (15)$$

If the poles be made conical, the elements of the cone being at 60° to its base, we have, substituting in Eq. (14) the proper values—

$$T = \sqrt{\frac{(M.\,M.\,F.)^2 \times A \times 2}{p \times \phi \times 0.5}} \qquad (16)$$

$$= \sqrt{\frac{(M.\,M.\,F.)^2 \times A \times 4}{p \times \phi}} \qquad (17)$$

$$= \sqrt{\frac{(M.\,M.\,F.)^2 \times A}{p \times \phi}} \times 2 \qquad (18)$$

Eq. 18 gives a value of T double that in Eq. (15); that is, the length of travel of plunger may be doubled with the same m. m. f. and initial pull by shaping the pole faces conically with the angle being 60° between the base of the cone and the elements.

BALTIMORE, MD. LAMAR LYNDON.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Temporarily Conducted by E. F. ROEBER, Ph. D.

DYNAMOS, MOTORS AND TRANSFORMERS.

The Moment of Inertia of the Rotor of a Dynamo.—HAY.—The first part of an article in which he shows that the moment of inertia of a dynamo armature is of great importance, especially in connection with two problems: the analysis of the various losses which take place in a dynamo, and the problem of parallel running of alternators. He then begins to describe some methods of determining experimentally the moment of inertia of a dynamo rotor. He first deals with the method of torsional vibrations which may be conveniently used so long as the rotor is not of unwieldy size. The rotor is suspended by means of a steel wire rope with its axis vertical, and, having been displaced by a rotation round its axis through a convenient angle from its position of equilibrium, is allowed to oscillate, the time of a complete oscillation is determined. The moment of inertia of the rotor is next increased by suitably loading it with weights distributed symmetrically round the axis, the weights being of such a shape and so placed that the total additional moment of inertia due to them may be calculated; the new time of oscillation is measured; then the moment of inertia of the rotor can be easily calculated.—Lond. *Elec. Rev.*, Aug. 24.

REFERENCES.

Polyphase Induction Motors.—OSSANNA.—An illustrated paper in which he gives an abstract of his long article, noticed in the Digest July 1, 1899. He develops the theory of polyphase induction motors by a graphical method, which in general is similar to that of Heyland, but more exact and simpler in some points.—*Elek. Zeit.*, Aug. 23.

Compound Wound Dynamos.—Four illustrated communications describing methods of winding the shunt and series winding of a compound dynamo on separate formers in such a manner that it is possible to remove either the shunt or series field winding without disturbing the other.—Lond. *Elec. Eng.*, Aug. 24.

LIGHTS AND LIGHTING.

REFERENCES.

Bremer Arc Light.—WEDDING.—In a continuation of the account of the proceedings of the recent annual meetings of the German Elec. Eng., the illustrated translation of Wedding's paper (Digest, Sept. 1) is concluded.—Lond. *Elec. Eng.*, Aug. 24.

Base of Incandescent Lamps.—A brief description of two modified forms of the Hollub lamp, noticed in the Digest Aug. 18.—*L'Elec.*, Aug. 4.

POWER.

Sao Paulo.—An illustrated description of the hydraulic plant of the Sao Paulo Tramway, Light & Power Company. Sao Paulo is a city of 260,000 inhabitants in Brazil. The power plant is situated 21 miles from the city; the initial installation will consist of three turbines of about 2000 horse-power capacity, directly connected to three-phase alternators with step-up transformers to give a pressure of 25,000 volts. The power house is designed with a view to large additions. The maximum amount of water power available will be at least 140,000 horse-power, and the minimum amount not less than 16,000 horse-power for 10 hours per day. It is expected to have the hydraulic power plant in operation by the first of next year. The transmission line consists of two independent three-phase circuits of No. 0 bare copper wire supported upon octagonal wooden poles. A loss of 10 per cent is estimated. The current is transformed down to 2300 volts at Sao Paulo in a sub-station. It is converted by motor generators to 500 volts direct current for supplying the railroads. The distribution for lighting will be single-phase alternating current at 2300 volts, two-wire primary, with a network system of three-wire secondary mains at 115 volts. A complete system of circuits for power distribution will also be installed, consisting of three-phase 430-volt underground circuits in the central section of the city. A temporary steam plant is at present in operation, while the hydraulic power station is being constructed.—*St. R'y Jour.*, Sept. 1; Int. Ed., September.

Railway Water Power Plant.—BURCH.—A paper read before the Northwestern Railway Club on the water power plant which supplies power for all electric lines in Minneapolis and St. Paul. The total capacity of the plant is about 10,000 horse-power. Three voltages are used: 550 volts direct current for the nearby lines, 3500 volts alternating current for transmission to the lines at a medium distance away from the station, and 12,000 volts alternating current for transmission to the lines at a considerable distance.—*St. R'y Jour.*, Aug. 11, and Int. Ed., September.

REFERENCES.

Electricity in Large Cities.—Barstow.—An article discussing some general questions regarding the generation, transmission and distribution of electrical energy in large cities.—*Cassier's Mag.*, September.

Power Transmission.—Aliamet and Brunswick.—The first parts of a long article in which they treat in an elementary manner the principles of power transmission with direct current and with alternating current.—*L'Elec.*, July 21, Aug. 11.

TRACTION.

Electrolysis by Tramway Return Currents.—Claude.—A long illustrated paper, read before the Int. Soc. of Electricians in Paris, in which he gives an account of experiments made by him during the last two years on lines installed by the French Thomson-Houston Company. The return currents can become detrimental to gas and water pipes only at those points where they pass over from the pipes

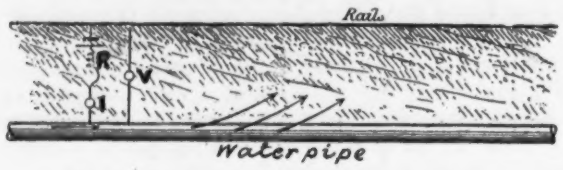


FIG. 1.—ELECTROLYSIS BY RETURN CURRENTS.

into the earth, under the supposition that the earth conducts the current as an electrolyte. He describes experiments in order to show that the latter is not the case to such a degree as is generally supposed. As shown in the adjoining figure, the negative pole of a battery of two or three cells is connected to the rails (when no cars are running), while the positive pole is connected by a rheostat *R* and an ammeter *I* to a water pipe, so that the current returns from the pipe through the earth to the rails; if the earth would behave like an electrolyte in form of a salt with a metal different from that of the electrodes (gen-

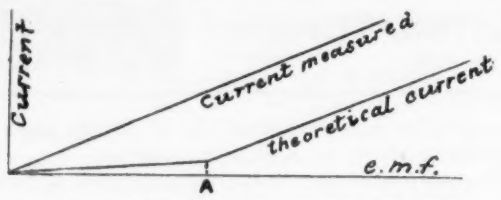


FIG. 2.—ELECTROLYSIS BY RETURN CURRENTS.

erally a sodium salt, while the electrodes are iron or lead), the following would be observed, while the potential differences between rail and water pipe, which is measured by the voltmeter *V*, is varied by means of the rheostat: with increasing e. m. f. the current would vary, as indicated in the adjoining figure by the curve "theoretical current"; the point *A* would correspond to the voltage required by the laws of electro-chemistry in order to allow the current to pass. His measurements, however, showed that the curve of the current is like that called "measured current" in the diagram—that is, that Ohm's law holds good, at least up to 2 volts; in other words, the earth does not behave like an electrolyte, but like a metallic conductor. He further describes measurements in which he has determined the stray currents; he has found that the ratio of the stray currents to the total return currents is much higher than generally supposed; it was found to be not below 12 to 15 per cent in lines with good rail joints, while it may rise to 25 or 30 per cent in lines where the joints are not carefully made; on the other hand, by far the greatest part of these stray currents travels simply through the earth and only a very small part goes through the water pipes. This small part, however, could become detrimental during a long time, if the earth would conduct the currents as an electrolyte; he has found that this is not the case, but the earth behaves like a metallic conductor shunted by an electrolytic conductor. He has confirmed the observations of Herrick. He finally makes some suggestions how to prevent electrolysis; the main point is to make careful rail joints; further, he recommends to multiply the return feeders in such a way that, for instance, instead of one feeder with a cross-section of 200 sq. mm., two feeders, each of 100 sq. mm., should be used, connected to two points in a certain distance; he thinks that it would be sufficient to use only one feeder from the station and to connect it by expansions of equal resistance with points of the rails in distances of several hundred meters.—*Bull. de la Soc. Int. des Elec.*, June; *L'Eclairage Elec.*, July 28; more briefly in *L'Ind. Elec.*, July 25.

Three-Wire System for Railways.—Henry.—A communication in which he agrees with Bell's warning against the extravagant use of polyphase transmission for railways (Digest, Aug. 25). He does not agree with the present method of distribution; he says that it is wrong to use high voltage in the congested districts and low in the suburbs. He advocates a three-wire compensating system, the ordinary generators being used, but coupled in Edison's three-wire way. Those on one side which are to supply the congested districts are arranged for, say, 450 volts, while the other side which supply the outskirts, are arranged for, say, 650 volts. Such an arrangement would effect a great saving in copper, and would diminish the trouble of electrolysis. If it is desired to extend the road to other towns, the ordinary motors might be used safely and have all the advantages of a distribution at 1100 volts. This would require a double trolley, each to be in connection with the outside terminals of the three-wire system. The motors would be run in series.—*St. R'y Jour.*, Sept. 1.

Notes from Germany.—An article stating that the effect of the new law which gives the right of way to telephone and telegraph lines to be strung on the public roads is being felt. Various cities like Berlin, Charlottenburg and Breslau have adopted resolutions which plainly show that in the future they will build electrical roads themselves. German steam railways are feeling the effects of suburban trolley traffic; one road has discontinued the use of four trains during week days. The Wannsee Railway (see abstract below) proved so successful in its recent trial that the military authorities intend to continue the experiments on the military road connecting Berlin and Mariendorf; the trials are being conducted by the society devoted to the study of high-speed electric roads; three-phase current is furnished at a pressure of 12,000 volts; in the cars themselves the voltage is reduced to 1000 volts; it is desired principally to show by these trials that the desired speed of 120 miles per hour can be attained. The electric omnibus line which was opened a few weeks ago in Berlin may be considered a formidable competitor to the electric street car lines. The power station of the electric elevated and underground road at Berlin is nearing completion; when finished there will be three steam engines, each of 900 horse-power, direct connected to direct current generators of 800 kilowatts. The Munich Tramway Company has completed the electrical installation on its road; considerable difficulty was experienced in convincing the artists that trolley wires would not injure the appearance of the street, and the company was compelled to proceed around some of the monuments by small side streets.—*St. R'y Jour.*, Int. Ed., September.

Wannsee Railway.—Some notes on the Wannsee Railway, which is a suburban railway of 7 miles length between Berlin and Potsdam. Recently the first electric train was run. The electric equipment of this line has been made for the purpose of getting reliable data on the electric haulage of trains, in order to apply them for more general use of electric traction on main lines. At present only six electric trains are run per day; it is, however, proposed to increase this number to 30. The train, which can carry 410 passengers, weighs 210 tons, and consists of 10 three-axle cars; the two end cars are motor cars. The train is hauled by six series-wound motors, each of 150 horse-power, coupled direct to the axles of the motor cars. The train is controlled from the first motor car, and is lighted by 120 incandescent lamps. On each side of the train there are six sliding contacts for collecting the current from conducting rails, laid at the side of the track rails which are used for the return currents. The current is furnished by the tramway station of a town in the neighborhood; there are two storage battery sub-stations.—*Elek. Zeit.*, Aug. 16.

Electric Traction on Trunk Railroads.—Heft.—A paper to be presented at the Railroad Congress at the Paris Exposition. Three trunk lines in the United States have experimented with electric traction, the New York, New Haven & Hartford Railroad, the Pennsylvania Railroad and the Baltimore & Ohio Railroad. The first road is operating about 80 km of secondary railway track, mostly third rail; the second about 12 km of secondary railway track trolley; the third about 6 km of trunk line track trolley on the belt and tunnel line in Baltimore. The experience of the three companies is given in the form of a series of questions and answers, and in the appendix is given detailed information about each road. He recommends strongly the use of electricity under certain conditions, as giving as good service and being cheaper than steam, the wear on track being less and passenger receipts more.—*Int. Bull of R. R. Cong.; St. R'y Jour.*, Int. Ed., September; first part in *St. R'y Jour.*, Aug. 25

Wing Trolley.—A brief illustrated article on two inventions of

Pearson. One is the "wing trolley," designed to make it more easy to get the trolley wheel onto the trolley wire, and also to make it more difficult for the wheel to leave the wire on the curves; it is an ordinary trolley with wings, which need not project more than half an inch, and a slot and pin penetrating the shank of the fork of the pulley, and, being parallel with the latter, allows it to swivel at curves, but prevents it getting across the wire by the ends coming in contact with the sides of the slot. The other invention is a "traveler" which has for its object the prevention of accidents of the kind which have occurred in consequence of the rope from the trolley head hanging loose. The traveler automatically keeps the rope confined at the bottom of the trolley pole when the rope is not in use; it weighs a few ounces and consists of two skeleton plates, comprising a frame for mounting rollers at the top and bottom.—Lond. *Elec. Eng.*, Aug. 24.

Deficiencies in Car Equipments.—TWEEDY.—An article recommending continuous automatic lubrication for a traction motor; the oil should be kept where it is wanted; while oil does find its way onto the commutator, it is advisable to use moulded micanite rather than mica as the insulating medium—except, of course, for the intersegment insulation—as oil finds a comparatively easy path between the laminae of the built-up mica, and the insulation is broken down more quickly than when the solid micanite is used; moreover, micanite is cheaper, and is much easier to handle. He says that the majority of the traction motors in use are not enclosed enough, and that the motor cases should be made water-tight.—Lond. *Elec. Rev.*, Aug. 24.

Wichita Electric Railway.—HUGHES.—An illustrated article on the early Wichita electric road built in 1887. It was constructed on the series system—that is, the same current passed through each car on the system and was returned to the power station by separate wire. The current was kept constant and the variation in the power was obtained by varying the voltage. This required quite a complicated overhead construction. Each car had two trolley poles, and the trolley wire was divided into sections with section switches. The forward trolley opened one of these switches and the rear trolley closed the switch.—*St. R'y Jour.*, Sept. 1 and Int. Ed., September.

REFERENCES.

Small Electric Railways.—CAHOON.—The conclusion of his article, in which he discusses whether small electric roads can be operated at a profit (Digest, Aug. 25). He discusses the subject of roadbed construction, and remarks that it is most unreasonable when municipalities require that small tramway companies shall keep the pavement of the street in good repair. He recommends frequent tests of the overhead construction to determine leaks, also neatness about the power station and power houses, and makes some remarks on the inspections of car equipments and on the treatment of employees.—*St. R'y Jour.*, Sept. 1, and Int. Ed., September.

Niagara Gorge Railroad.—RICKER.—An illustrated article on the experience of the first five years in maintaining this railroad. There were great topographical difficulties.—*St. R'y Jour.*, Sept. 1 and Int. Ed., September.

Paris.—GOSSELIN.—An illustrated English translation of his paper read before the Int. Soc. of Elec. in Paris (Digest, June 2), on the Bois de Boulogne combined trolley and surface contact system.—Lond. *Elec. Rev.*, Aug. 17.

Paris.—An illustrated description of the Metropolitan Railway at Paris; the third-rail system is used with track rail returns, as already noticed in the Digest.—Lond. *Elec. Rev.*, Aug. 24; a very long and fully illustrated article on this railway in *St. R'y Jour.*, Sept. 1, and Int. Ed., September.

Columbus.—An illustrated article on the operating methods of the Columbus Railroad Company. Reference is made to the efforts to induce traffic by erecting parks, etc. The company had a number of small cars and these have been made into long cars by splicing two together. The track construction is described; also an automatic signal system used on single track roads between switches.—*St. R'y Jour.*, Sept. 1; Int. Ed., September.

Sunderland.—A well-illustrated article on the municipal electric tramway system of the seaport town, Sunderland. The first 12 miles of electrically equipped track were recently opened. Power is supplied from the municipal lighting station, but from separate sets of machines. The trolley system is used, the voltage being 500.—Lond. *Elec.*, Aug. 24; another illustrated description in Lond. *Elec. Rev.*, Aug. 24.

Philippine Islands.—RICE.—An article on possibilities of electric railway development in the Philippine Islands. There are no electric roads there, although the cities could well support such lines. They cover a wide area, and transportation is expensive. As in Manila, the most of the streets are very narrow, a short and narrow car will have to be used. Labor is cheap, and the construction of an electric road would not be expensive.—*St. R'y Jour.*, Sept. 1, and Int. Ed., September.

France.—A statistical article on electric traction in France in 1899.—*L'Elec.*, July 21.

Train Resistance.—DANIEL.—A paper read before the Northwestern Railway Club. He refers to the statement made by earlier experimenters, that a reduction of 85 per cent can be made in axle friction by substituting oil bath lubrication in place of the common pad lubrication; also a strong side wind may increase the resistance by 60 per cent. He gives a number of formulas which have been proposed, and believes that one suggested by Blood is the best. He analyzes the different factors of the resistance and gives some results obtained by him on a steam railroad last winter.—*St. R'y Jour.*, Aug. 18, and Int. Ed., September.

Breaking of Trolley Wires.—SEMENZA.—A brief communication, with photographs of broken trolley wires, all of which show marked characteristics. The broken surface is never homogeneous, but consists of one part showing fresh break and one or two other parts showing a series of concentric zones of brown oxide, indicating a slow deterioration.—*St. R'y Jour.*, Sept. 1, and Int. Ed., September.

Conduit System.—An illustrated anonymous communication in which the writer briefly describes a conduit system which he claims to be much cheaper than the usual conduit system.—Lond. *Elec. Rev.*, Aug. 24.

Accessories of Electric Traction.—COTTRELL.—A continuation of his long serial (Digest, Sept. 1). After brief remarks on feeder panels, output panels, leakage panels, equalizing panels, instruments for the test room and switchboards, he begins to deal at some length with the construction of the overhead trolley wire.—Lond. *Elec. Rev.*, Aug. 24.

Inclined Elevator.—A reprint of the illustrated English article on the Reno inclined elevator in the Crystal Palace in London, noticed in the Digest Sept. 1.—*El'ty*, Aug. 29.

Track Construction.—An article on standards of track construction on American railways, with three large tables giving a large amount of information on the track construction of 47 of the principal lines in all parts of the United States, the two great railway systems of Canada, and three railways in Mexico.—*Eng. News*, Aug. 30.

Changing from Cable to Electric Traction.—An illustrated article on the changing of the Broadway tramway in New York from cable to electric traction.—*St. R'y Jour.*, Sept. 1.

Electric Launches.—An illustrated article on electric launch service at Jackson Park, Chicago. Each launch has 60 cells, rated at 120 amp-hours.—*West. Elec.*, Sept. 1.

Automobiles.—ZECHLIN.—A longer abstract of his paper on improvements in the construction of battery motor cars, noticed in the Digest June 30.—Lond. *Elec.*, Aug. 24.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Keeping the Pressure of a Storage Battery Constant.—An illustrated description of two devices for automatically keeping the pressure constant with varying loads. In the first an iron core is drawn against the resistance of a spring into a solenoid, connected across the mains; by a suitable gearing a contact block is moved over contacts, which thus cuts out or puts in cells to keep the pressure constant.—Lond. *Elec. Eng.*, Aug. 24.

REFERENCES.

Combined Lighting and Power Plant.—PERKINS.—His paper in full read before the Ohio Elec. Light Ass'n and abstracted in the ELEC. WORLD AND ENG. Aug. 25, page 284.—*West Elec.*, Sept. 1.

Switchboards.—PERKINS.—The concluding part of his serial on modern switchboard practice (Digest, Sept. 8). It deals with single phase alternating-current switchboards.—*West. Elec.*, Sept. 1.

Switch Gears for High Pressure Alternating Currents.—WARRILOW.—Continuations of his illustrated article (Digest, Sept. 1), describing switch gears of the Brush Elec. Eng. Co., Crompton & Co. and Fowler & Sons.—Lond. *Elec. Eng.*, Aug. 17, 24.

Stockport.—An illustrated description of the Stockport electric plant. The three-wire direct-current system is used with 460 volts between the outers.—Lond. *Elec. Rev.*, Aug. 17.

Leigh.—An illustrated description of the Leigh municipal electric plant. The three-wire direct-current system is used with 440 volts between the outers.—Lond. *Elec. Eng.*, Aug. 17.

Edison Central Stations.—Vail.—An historical article on the growth of the Edison central station business.—*Elec. Rev.*, Aug. 29.

Wires, Wiring and Conduits.

Use of Aluminum for Electrical Conductors.—Kershaw.—The first part of an article in which he gives a summary of recently published facts and figures relating to the use of aluminum as an electrical conductor. The relative conductivity of 99.6 per cent aluminum, taking copper 100, and equal sectional areas, is about 61; since it is customary, however, to alloy the aluminum designed for use in transmission lines with copper or iron in order to increase its strength, it is unfair to use this figure in general calculations regarding relative costs; for alloys with 0.50 or 0.75 per cent of copper the conductivity is decreased to about 58 and 56, respectively; each lot of aluminum wire or cable ought to be tested separately for conductivity before erection on any power transmission line, and the percentage of copper and iron added to the metal ought to be kept as low as is consistent with the desired strength of the line. The tensile strength of hard-drawn copper wire is between 62,000 lbs. and 65,000 lbs. per square inch; the tensile strength of aluminum wire is much lower, and varies from 18,000 lbs. to 40,000 lbs., according to the impurities present, and the annealing it has undergone; the tensile strength of aluminum and copper alloys varies greatly; he gives several figures on this point. Regarding the relative costs of copper and aluminum, he states that aluminum has been offered and sold in rod or wire form in America, for electrical transmission work, at 30c. per lb., and in Europe at only a slightly higher cost; for copper he takes the latest quotation for copper in rod form, 18c. per lb., and assumes the relative conductivities at 59.9 and 100, then the relative costs of aluminum and copper for conductors of equal electrical capacity work out to 100 and 123; these figures represent, however, the relative costs of the metals only, without consideration of the costs of erection, etc. He then speaks about the methods of erecting and jointing aluminum transmission lines, and refers to the recent A. I. E. E. paper by Perrine and Baum; it seems that the erection of aluminum lines is more troublesome than when copper is the metal used, and, therefore, the cost of erection will be somewhat higher in the case of aluminum, but exact figures bearing upon this point are lacking.—Lond. *Elec.*, Aug. 24.

REFERENCES.

New Insulating Compound.—A brief article on tests made by Duncan with a new insulating material of a plastic character of secret composition. In the tests the insulation broke down at 25,600 volts. But it is claimed that "a wire capable of withstanding a constant pressure of 100,000 volts alternating may easily be made," and that the cost of the insulating compound is only 3 per cent of that of rubber compounds.—*Elec. Rev.*, Aug. 29.

Electric Conductors and Dust.—Baily.—A reprint of the English article abstracted in the Digest Sept. 1.—*El'ty*, Aug. 29.

Electro-Physics and Magnetism.

Magnetic Force of the Atoms.—Lang.—A paper on the small currents which, according to Ampere, circulate around the molecules of the magnetic metal. He works out Richarz's theory that these molecular currents are convection currents of revolving ionic charges; these convection currents are produced by the revolution of the negative electrons around the heavier positive electrons, just as the moon rotates around the earth. Richarz had shown the admissibility of his theory by calculating the magnetic moment of saturation for iron direct and finding it to agree as regards order of magnitude closely with the experimental value. The present author shows that this proof can also be brought while using values differing essentially from those used by Richarz; that thus a connection is obtained between minimum atomic volume and magnetism which up to the present has also been empirically recognized; that with regard to atomic magnetism the unsaturated valencies appear to play an important part; and that the new hypothesis permits the consistent explanation of several phenomena hitherto imperfectly understood.—*Ann. der Physik*, No. 7; translated and commented upon in some editorial notes on the theory of electrons in Lond. *Elec.*, Aug. 24.

REFERENCES.

Electric Force.—Shettle.—An article giving "some remarks upon the cause and nature of the electric force." He assumes the origin of matter by condensation of a hypothetical primary stuff of uniform density. "Disturbance of equilibrium in such original stuff would be the one great primary cause for the subsequent evolution of all natural phenomena." He then gives his view of the phenomena of static electricity. "The synthetic formation of water is an illustration of the mode in which condensation is effected by sending charges of static electricity; or, in other words, charges of accumulated ether, through a mixture of gases, oxygen and hydrogen." He further deals with galvanism and with the contact and the chemical theories.—Lond. *Elec. Eng.*, Aug. 24.

Nature of Electricity.—Fletcher.—An article giving some notes on Shettle's view of the ultimate nature of electricity (see above).—Lond. *Elec. Eng.*, Aug. 17.

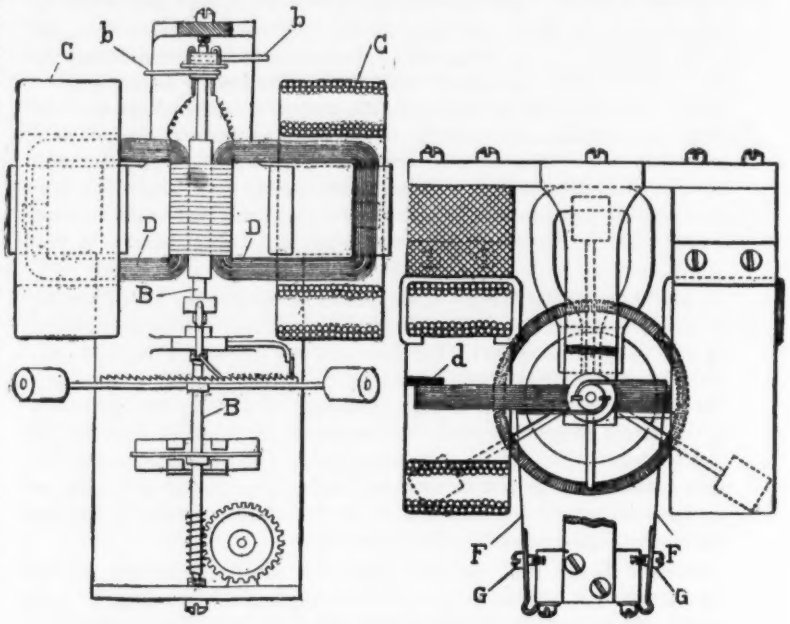
Electro-Chemistry and Batteries.

REFERENCES.

Calcium Carbide Industry in Bavaria.—A note, taken from a consular report, on the growing industries in calcium carbide and acetylene in Bavaria. Acetylene gas is largely used in Bavaria for various lighting purposes. The first acetylene gas plant for lighting a small town was erected at Hassfurt, a town of 2500 inhabitants. There are no less than 26 small towns in Germany thus lighted.—Lond. *Elec.*, Aug. 24.

Units, Measurements and Instruments

Holden Energy Meter.—Garfield.—A well illustrated description of the Holden energy meter, which is based upon the following principle: at periodic intervals the movable shunt coils of a wattmeter of



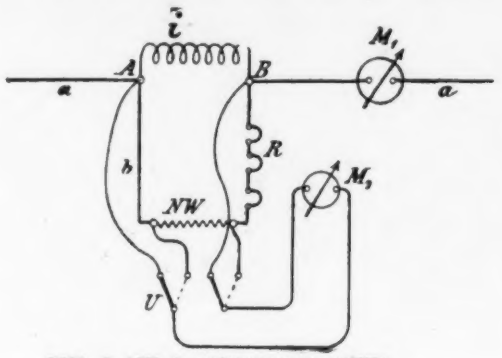
FIGS. 1 AND 2.—SECTION AND PLAN OF HOLDEN METER.

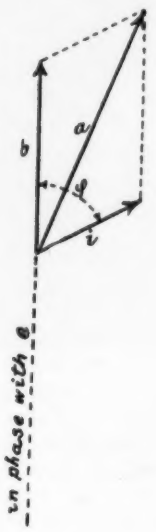
the electrodynamometer type are connected to the circuit and are thus deviated under the action of the fixed series coils; these deviations give to a kind of carriage which can rotate around a vertical axle, a certain amount of kinetic energy which is consumed by the damping action of a metallic disk rotating between the poles of a permanent magnet; it is arranged so that the angle by which the carriage revolves around the axle is proportional to the power at each moment when the shunt coils of the wattmeter are connected to the circuit; a wheel-work sums up all angles of rotation, so that the sum corresponds to the total energy during the whole time. The adjoining figures show the construction of the Holden meter. The upper part is the wattmeter of the electrodynamometer type, *D D* being the movable shunt coils, *C C* the fixed series coils. The shunt coils can turn around the axle *B* against the action of the springs *F F*, the angle of rotation being limited by the pins *d d*. The lower part of the instrument which turns around the axle B^1, is what was called above a kind of carriage. The axle B^1 has three horizontal arms, provided with weights; these three arms bear a toothed circle, so that by means of a click, fixed on the upper axle *B*, the lower axle B^1 is dragged around when the upper axle *B* is deviated. Below these three arms on the axle B^1 a metallic disk is fixed which rotates between the poles of a permanent magnet. Below this disk there is a screw which operates the counting wheel-work. Besides these parts the instrument has a device by which the shunt coils of the wattmeter are connected to the circuit at periodic intervals; this is done by means of a specially

constructed clockwork.—*L'Ind. Elec.*, July 10; another illustrated description of this instrument, by Montpellier, in *L'Elec.*, Aug. 11.

Interrupter.—BAINVILLE.—An illustrated description of an interrupter devised by Bouchet, which is somewhat similar in its principle to that of Haerden (Digest, Sept. 8), the interruptions being made between two mercury surfaces by means of a mechanical device. A box is divided into two parts by a partition which does not reach up to the full height of the box; both parts contain mercury which in general does not reach the top of the partition; the two quantities of mercury are connected to the circuit which is to be closed and interrupted. Through the upper cover of the box two plunger-pistons can be plunged into the two quantities of mercury so that the mercury rises over the top of the diaphragm and makes contact.—*L'Elec.*, July 21.

Measuring the Power in Alternating Current Circuits.—REISZ.—An illustrated article in which he shows how to measure the power in an alternating current circuit with one ammeter and one voltmeter; this method may be used when the power is so small that it cannot be well measured with an ordinary wattmeter. In the adjoining figure the power between the terminals of the apparatus *A B* may be to be





FIGS. 1 AND 2.—MEASURING POWER.

determined. The currents are *a*, *b*, *i*, as shown in the figure, *a* being the geometrical sum of *b* and *i*, as illustrated in the second diagram. M_1 is an ammeter, M_2 is a voltmeter. *N W* is a non-inductive standard resistance for determining the current *b* from the voltage determined by M_2. From the second diagram follows a simple trigonometrical formula between the four quantities *a*, *b*, *i* ϕ; *a* and *b* are measured. Then the resistance shunted between *A* and *B* is altered (by varying *R* in the diagram); the voltage between *A* and *B* must, however, remain constant, which can be examined with M_2 by means of the switch *U*. Now the new values of *a* and *b* are measured; *i* and ϕ are the same as before, as the voltage between *A* and *B* has not been changed; he thus obtains a second equation so that *i* and ϕ can be calculated.—*Elek. Zeit.*, Aug. 23.

REFERENCES.

Gas Thermometer.—HOLBORN AND DAY.—A second paper on their investigation, made in the German Reichsanstalt, regarding the use of the gas thermometer as a standard at high temperatures. They recommend to use pure nitrogen as the expanding gas in a bulb of platin-iridium. They have determined the corrections which the observations of such a gas thermometer require on account of the expansion of the bulb, and have measured quite a number of melting points of pure metals.—*Am. Jour. of Sc.*, September.

Hot Wire Instruments.—LLOYD.—A communication in which he defends the hot wire instruments against the criticism of Stevens (Digest, July 28).—*El'ty*, Aug. 29; *Elec. Rev.*, Aug. 29.

New Application of Price's Guard Wire in Insulation Tests.—AYRTON AND MATHER.—The Brit. Phys. Soc. paper, with illustrations, abstracts of which were noticed in the Digest Feb. 24.—Lond. *Elec. Rev.*, Aug. 24.

Fault Test for Cable Core.—APPLEYARD.—The illustrated Brit. Phys. Soc. paper, abstracts of which were noticed in the Digest Feb. 24.—Lond. *Elec. Rev.*, Aug. 24.

TELEGRAPHY TELEPHONY AND SIGNALS.

Telegraphy in Great Britain.—Some editorial notes on the British Postmaster General's annual report on the post and telegraph service during the last year. The telegraph revenue increased by $1,001,735, while the expenditure increased by $1,334,580, resulting in a net deficit of $1,442,190. Against these financial shortcomings there is abundant evidence that the telegraph service continues to grow both in efficiency and popularity.—Lond. *Elec.*, Aug. 24.

REFERENCES.

Munich.—The first part of a very long illustrated article on the telephone exchanges of Munich, Germany.—*Elek. Zeit.*, Aug. 23.

Telephone Switchboard.—MONTILLOT.—A long, well illustrated description of the new multiple switchboard, now in course of construction, for the central station of St. Etienne.—*L'Elec.*, Aug. 4, 18.

Telephone Switchboard.—ANIZAN.—An illustrated description of the Postel-Vinay multiple switchboard.—*Jour. Telegr.*, Aug. 25.

Highway Grade Crossing Alarms.—EVANS.—A paper on the protection of highway crossings by means of automatic alarms.—*Eng. News*, Aug. 30; *West. Elec.*, Sept. 1.

Switzerland.—The first part of a long statistical article on telegraphy and telephony in Switzerland during 1899.—*Jour. Telegr.*, Aug. 25.

MISCELLANEOUS.

The Education of an Electrical Engineer.—An editorial, in which it is said that it is impossible to lay down any rigid rules, or to recommend any rigid scheme for the education of an electrical engineer, as each case should be considered on its own individual basis. It is recommended that a youth should take his studies first at a technical college and then the more practical training of the workshops or power station; the first year or two of a student's college course should be practically independent of the special branch of the electrical profession he will ultimately enter; students are warned against a too early and too exclusive absorption into what is termed research work. When the college course is ended, the student should regard it as almost, if not quite essential, that he should pass completely through the workshops of an electrical or mechanical engineering works of high standing.—Lond. *Elec.*, Aug. 24.

REFERENCES.

Electrical Engineers in Paris.—An article on the joint meeting of the American and English Institutes of Elec. Eng. in Paris.—Lond. *Elec. Eng.* and *Elec. Rev.*, Aug. 24; *Lightning*, Aug. 23.

Paris Exposition.—An article on electric power transmission at the Exposition.—*Mech. Eng.* (Manchester, England); *Elec. Rev.*, Aug. 29.

A long illustrated article on the boilers at the Exposition.—*Power*, September.

BOYER.—An illustrated article on French electrical exhibits.—*Cosmos*, Aug. 25.

KORDA.—The first part of a well illustrated article on dynamos exhibited by French firms.—*Elek. Zeit.*, Aug. 23.

BORCHERS.—Continuations of his article on electro-chemical exhibits (Digest, Sept. 1), dealing with the mineral products of Western Australia, Norway, Sweden, Russia, Servia and Austria.—*Zeit. fuer Elektrochemie*, Aug. 16, 23.

RUHMER.—An illustrated description of an apparatus devised by Boas and exhibited by the General Electric Co., of Berlin, for stereoscope pictures with Roentgen rays.—*Phys. Zeit.*, Aug. 25.

An illustrated description of a steam-driven 350-kw Mather & Platt direct-current generator.—*Am. Elec.*, September.

An illustrated article on the 1600-kw transforming station supplying the transportation systems at the Exposition.—*Amer. Elec.*, September.

A well illustrated description of a 1000-hp turbine exhibited by Ganz & Co.—*Am. Elec.*, September.

DARY.—An illustrated description of an apparatus, exhibited by Grauer & Co., for galvanic nickeling.—*L'Elec.*, July 28.

An article on exhibits of German electrical firms.—*Elek. Anz.*, Aug. 12.

An illustrated description of electric clocks operated by polyphase currents, the system being devised by Thury and exhibited by Cuenod.—*Revue de l'Elec.*, Aug. 15.

LAFFARGUE.—An illustrated article on the distribution of electrical energy in the Exposition.—*La Nature*, Aug. 18.

An illustrated article on the exhibition of Nernst lamps.—*Sc. Amer.*, Sept. 1.

An article on the Dardeau system of telephony (Digest, Aug. 18) used on the moving platform.—*Eng'ing*; *Sc. Amer. Sup.*, Sept. 7.

An illustrated description of an electric locomotive exhibited by the General Electric Co., of Berlin.—*Elek. Rund.*, Aug. 15.

An illustrated article on gas-driven dynamos exhibited by Koerting Bros.—*Zeit. fuer Beleucht.*, Aug. 20.

Dary.—An illustrated description of a device exhibited by Ducot, for registering on a dial the number of ounces of metal which are deposited from an electrolytic bath upon the subjects to be plated, and for interrupting automatically the current at a certain moment wanted. —*L'Elec.*, July 21.

A continuation of the illustrated serial, dealing with generating sets, exhibited by French firms.—Lond. *Elec.*, Aug. 24.

New Books.

BOOKS RECEIVED.

Le Magnetisme du Fer. Par Ch. Maurin. Paris: Georges Carré et C. Naud. 100 pages, 20 illustrations. Price, 2 francs.

La Theorie de Maxwell et les Oscillations Electrique. Par H. Poincaré. Paris: Georges Carré et C. Naud. 80 pages, 5 illustrations. Price, 2 francs.

Directory of Electrical Societies, Etc.

American Electro-Therapeutic Association. Next meeting, New York, Sept. 25, 26 and 27, 1900.

American Street Railway Association. Next meeting, Kansas City, Mo., Oct., 16, 17, 18 and 19, 1900.

Canadian Electrical Association. Next meeting, Ottawa, Ont., 1901.

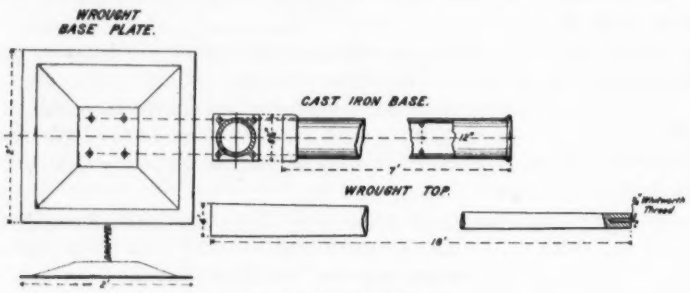
National Association of Municipal Electricians. Next meeting, Pittsburg, Pa., Sept., 25, 26 and 27, 1900.

Old-Time Telegraphers' Association and the U. S. Military Telegraph Corps. Next meeting, Minneapolis, Minn., Sept. 18, 1900.

Street Railway Association of the State of New York. Next meeting, Buffalo, Sept. 18 and 19.

Iron Poles for South Africa.

There is a demand in South Africa for iron poles for railway, telephone and electric lighting. The accompanying diagram gives the dimensions of the pole required for this service, and was forwarded to the State Department by Consul-General Stowe, at Cape Town. Consul Stowe states that the demand for these poles will be large,



DIMENSIONS FOR IRON POLE.

and that at the time of writing several thousand were needed. Heretofore England and Germany have supplied these poles, but Mr. Stowe thinks it is time for United States manufacturers to compete for this business. "No American manufacturer has been found," he says, "who can produce the tapered wrought top. Specifications have been furnished, and the invariable reply has been that only straight tops can be furnished." He submits the diagram in the hope that its publication may meet the eye of some manufacturer who can produce such a pole.

The Collins Automobile.

The Collins Electric Vehicle Company, of Scranton, Pa., operating under the patents of Mr. P. J. Collins, an electrical engineer of that city, is bringing out a line of automobiles possessing many points of novelty, some of which are illustrated in the accompanying views. It is the purpose of the company to furnish light-weight and easy-running electric vehicles which will travel long distances without recharging of the batteries. To this end particular attention has been given to the construction of the propelling motor whereby the weight has been reduced to a minimum and the highest efficiency maintained, while the controller and its circuits are intended to effect the greatest economy in the consumption of current under all conditions of road, speed and grade. Considerable ingenuity has also been displayed in the construction of the running gear, by means of which the forward and rear wheels may move vertically independently of each other in passing over obstructions, so as to reduce the jolting, thus causing the vehicle to ride easier and preventing the mechanical destruction of the batteries.

The steering is accomplished without the use of differential gears. In order to steer the vehicle the armatures, which are connected inde-

FIG. 1.—DELIVERY WAGON.

pendently to the rear wheels, are caused to vary in speed relatively to each other in rounding corners, and the forward wheels are simultaneously caused to turn mechanically on arcs of different radii by means of the steering lever. With a short throw of the handle, the forward wheels may be turned the maximum distance for steering, in which position the wheels are locked, owing to the peculiar construction of the forward axles and the steering lever, and the wheels may be easily moved into any intermediate position and held with but slight effort on the part of the operator.

Fig. 1 shows a delivery wagon made by the Collins Company. This vehicle, which weighs only 2000 lbs. complete with batteries, is adapted to run 12 miles per hour, and will travel 60 miles over ordinary roads or city streets with a single charge of the batteries. The vehicle carries 44 80-amp-hour cells having a maximum discharge capacity of 32 amperes. The vehicle shown is fitted with two motors and spur gearing, but a vehicle of the same type and capacity having the Collins single motor with double armatures, and adapted for a speed of 10 miles per hour, weighs only 1800 lbs. with the same equipment, and will travel 75 miles without recharging.

Fig. 2 is a cross section through the Collins motor having two arma-

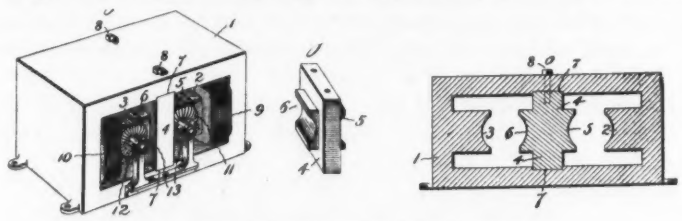


FIG. 2.—TWO-ARMATURE FIELD FRAME.

tures within a single field frame. The field frame, as shown, is of the armor-clad type having internal pole-pieces surrounded by coils on either end, and having a removable central partition provided with pole-pieces opposed to the pole-pieces on the ends. Two independent magnetic circuits are thus formed, the central partition forming a part of both circuits. This gives a very light and efficient construction, and the armatures can be varied in speed relatively to each other, to effect steering, by causing the fields to vary in strength without one being affected by the other.

For the sake of lightness and efficiency the motor is made small and the armatures turn at a comparatively high speed. The armatures are connected to the driving wheels independently through the medium of worm-gears, and the gears and motor are mounted upon a spring support hinged at one end to the rear axle, as shown in Fig. 3. The suspension of the motor deadens the humming noise of the high-speed armatures.

In order that the forward and rear wheels may pass over ordinary obstructions upon the road without tilting the vehicle body and without straining the reach or affecting each other to any extent, the reach is provided with bearings, *A* and *B*, in which is journaled a rod *C*, the latter being rigidly connected to the forward axle-casing *D*. This permits the forward and rear wheels to move vertically independently of each other.

The forward axles, *E* and *F*, as shown in Figs. 3 and 5, are journaled in the opposite ends of the axle-casing *D*, and these axles are offset rearwardly, the offset portion being longitudinally slotted. The steering lever *G*, which is operated by the steering head *H*, is also turned rearwardly at its opposite ends and provided with pins which engage the slots in the offset portions of the axles. In Fig. 3, the steering lever is shown in the central position, and in Fig. 5 the steering handle is turned to one side, which has the effect of turning the axles so that the inner wheel will turn on an arc of shorter radius than the outer wheel, and when the axles are turned into the extreme position shown in the engraving, they are locked against accidental displacement by obstacles upon the road. They may, however, be easily turned by the operator, and in any intermediate position the vehicle is easily controlled. The switch lever on the steering switch *I* is arranged beneath the axle-casing and adapted to turn with the steering head so as to vary the speeds of the driving armatures relatively to each other in order that the outer driving wheel may turn faster than the inner one in rounding curves; but the armatures will travel at equal speeds when the steering lever is in the central position.

Fig. 4 shows a pair of auxiliary motors used in connection with the forward wheels, in some cases. These motors are connected to the steering wheels through the medium of worm gearing and automatically operated clutches. The motors and gearing are mounted upon pedestals, *J*, secured to the axle-trunions. The clutches are operated by means of ball governors, *K*, which are driven from the shaft of the worm-gear. The arrangement is such that when the current is thrown on, the clutches engage the worm-wheel shafts with the driving pinions, and when the current is shut off, the clutches become disengaged. These motors, when applied to the forward wheels, are operated by switches which are independent of the steering switch. This arrangement for automatically connecting the worm-gearing with the driving pinions may also be applied to the rear wheels, so that when it is desired to permit the wagon to move under its own momentum, the clutches will become disengaged and the vehicle will travel without the retarding friction of the worm gears and motors.

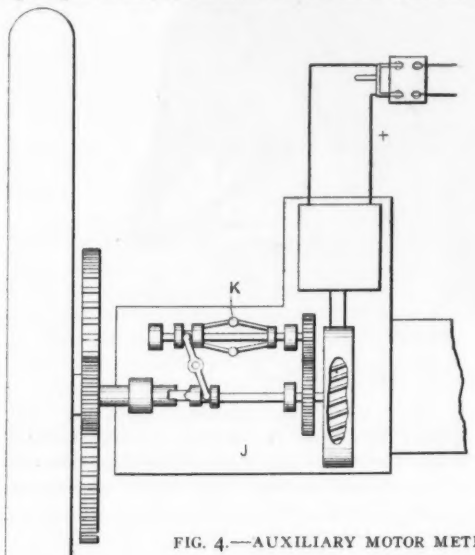


FIG. 4.—AUXILIARY MOTOR METHOD.

The speed of the driving motors is controlled by a vertically-movable lever connected with a controller, and the brake is also applied through the medium of this lever. This controller dispenses with the starting resistance and paralleling or grouping of the battery by substituting a commutator which produces commutation of the fields and armatures. By this method the vehicle can be accelerated from starting to full speed with less than the normal current of the motor, except the sixth speed, which takes a fraction above the normal. The controller has six speeds forward and rearward. The following is a table showing the variations in current in starting the vehicle shown in Fig. 1:

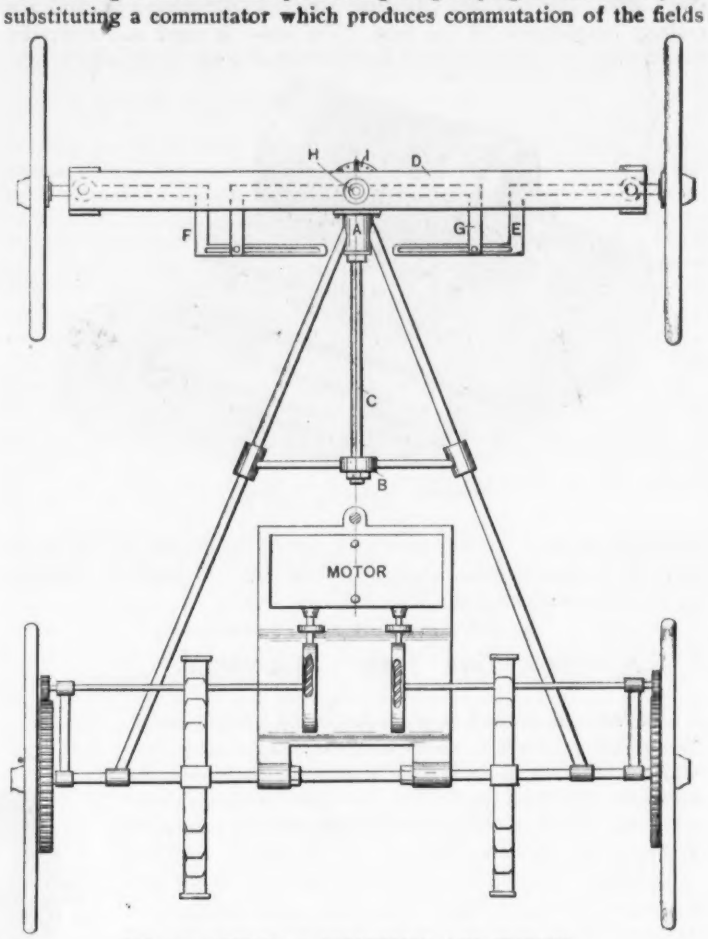


FIG. 3.—METHOD OF SUSPENSION AND GEARING.

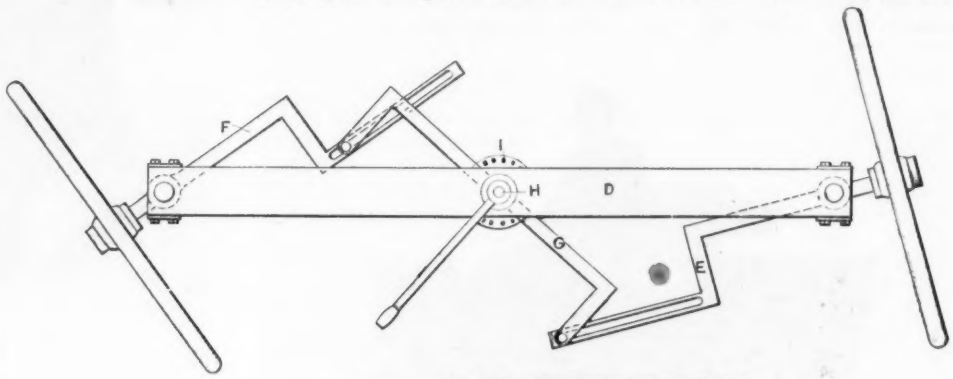


FIG. 5.—STEERING MECHANISM.

Position.	Momentary Current. Amperes.	Drop to. Amperes.
1	6	4
2	6	5
3	7½	6½
4	9	8
5	8	8
6	12	10

The fifth position is not intended for continuous use, its main office being to assist in making combinations for the sixth. It can, however, be used, if necessary, without injury to the motor, but is not so economical as the other positions.

Sparker Medical Battery.

The illustration on next page shows the Sparker medical battery, which is now being sold by Kendrick & Davis, Lebanon, N. H. It is

an inexpensive apparatus, but is said to do the work of a more expensive outfit. The coil and vibrating parts are self-contained, and are entirely independent of the base. The spool is rigid and stiff; the switch arm is of one piece, and bent in such a shape as to make it convenient to handle. All the metal parts are nickel plated, and the screw adjustments work easily. A spring under the coil keeps the regulating shell from slipping off.

SPARKER MEDICAL BATTERY.

A "New York Trap" Automobile.

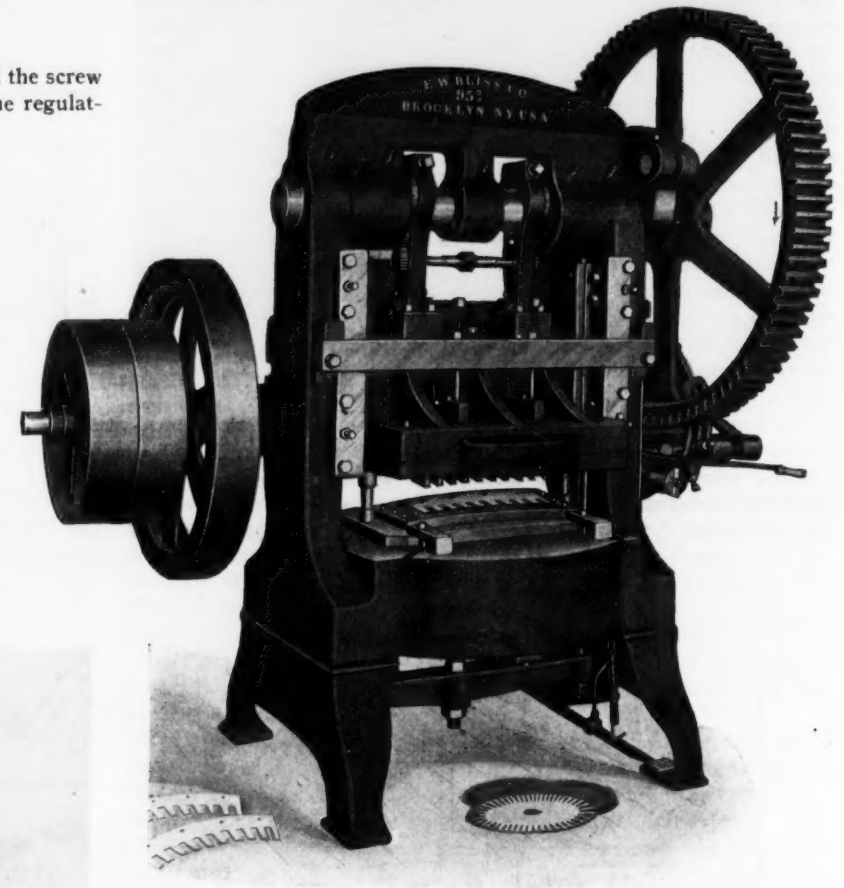
Out West there is a popular brand of oysters called "New York Dukes," which are excellent eating, but which cannot be described as at all familiar to the inhabitants of Manhattan. On the same principle, possibly, the National Automobile & Electric Company, of Indianapolis, whose advent into the "horseless" field has already been noted in these columns, makes its debut with a wagon called a "New York trap." There may be a vehicle of that generic type on the market unknown to New Yorkers, though familiar to the territory west of Buffalo. The name is a good one, however, and should stick. The machine is intended for park and boulevard use in large cities, and, as will be seen from our picture, has rather fine lines with a suggestion of power about it. As a matter of fact, it is powerful and has plenty of go, having a radius of about 50 miles on one charge of the battery. It is equipped with one 2½-hp motor geared directly to the rear hubs, and has a compensating gear in the motor shaft. The running gear frame is tubular, the wheels are wood with solid rubber tires, and the vehicle is fitted with ball bearings throughout. It has five speeds forward and three backward. The maximum forward speed is 15 miles an hour. It is substantially built, elegantly finished, and has been described by those who have witnessed its performance as moving with the quiet smoothness of a gondola.

THE "NEW YORK TRAP."

The National Company will have a line of electrics in some seven or eight styles, including road wagons with or without tops, Stanhopes, four-passenger brakes, small dos-a-dos park traps and combination delivery and pleasure wagons. The appearance of these at the Madison Square Garden next November will be noted with considerable interest. The officers of the National Company are L. S. Dow, president; A. C. Newby, vice-president, and P. Goetz, secretary and treasurer, all well-known men. Mr. Dow, who is at the lever in the delivery wagon here shown, has already taken an active part in antomobile development, and for many years was one of the leading spirits in the development of the great bicycle industry, in which he has a host of friends.

A "Bliss" Double Crank Press for Armature Disks.

In the accompanying illustration is shown the latest type of double crank press especially adapted for the rapid production of armature disks and segments. In position in the press will be seen a compound die for cutting at each stroke one complete segment, as shown at the left-hand side. As it is an essential feature of armature disks and segments to have the outside and inside segments exactly concentric, it has been found more satisfactory to adopt dies like the one shown, which, by cutting the edges simultaneously, eliminate the inaccuracies which are liable to occur when the cutting is done in two or more operations. Some complete disks for smaller generators, also punched at one stroke of this press, are shown in the foreground.



ARMATURE DISK PRESS.

In order to facilitate the operation of the press, it is provided with "throw-out pads" which work in a positive manner and consume but little power. The press is also provided with a direct-connected "knockout," actuated by the movement of the slide in connection with the two rods attached to the crosshead under the bed of the press.

These presses are made in a large number of sizes. The one shown is of the following dimensions: Distance between uprights, 40 ins.; distance between gibs, 35¾ ins.; standard opening in bed, 32 ins. round; distance from bed to slide when up, 12 ins.; standard stroke of slide, 2 ins.; adjustment of slide, 1 in.; size of flywheel, 45 ins. x 6 ins.; weight of flywheel, 1100 lbs.; proportion of gearing, 1 to 7½; floor space, legs, about 46 ins. x 67 ins.; weight complete, 15,500 lbs. This press has been built quite recently by the E. W. Bliss Company, 12 Adams Street, Brooklyn, N. Y.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call closed at 1¼ @1½ per cent, and time money at 3@3½ per cent for two, three and four months, and 4@4½ for six months. In the stock market an increase in activity was noted last week, but this was not sufficient or of such a nature as to cause any material and general change in prices. The increase in activity was thought to be due mainly to the return to the city of aggressive professional traders, and not to any substantial revival of outside interest. This latter condition is not much looked for until after the election, which is now absorbing men's minds. In the electric list, Brooklyn Rapid Transit was the only stock that received any special attention. It was subjected to bear attacks with subsequent recoveries, the net result of the operations being a loss of about ⅞ point. The sales for the week were 106,017 shares. General Electric was quiet, the sales being only 2470 shares. The closing quotation—138½—was ½ point lower than it was the week previous. Metropolitan Street Railway was the only one of the prominent electric stocks that closed at an advanced figure, the net gain being ½ point. There was not much activity in the stock, however, the sales being but 2587 shares. Western Union was quiet and unchanged as to quotation. Transactions in the market for outside securities were of larger proportions last week than the week previous, and a stronger tone prevailed. Several of the electric stocks showed considerable improvement, notably Electric Boat, but in none of these issues was the trading large. Following are the closing quotations at New York, Boston and Philadelphia:

NEW YORK.

	Sept. 1.	Sept. 8.		Sept. 1.	Sept. 8.
Gen. Elec.	139	138½	Elec. Veh.	16	17
Bklyn. Rap. Tran.	55⅛	54½	Elec. Veh., pfd.	30	40
Met. St. Ry.	154	154½	Gen. Car	5¾	6
Am. Tel. & C.	90	88	Ill. Elec. Veh. Tran.	1¼	1
West. Un. Tel.	80	80	N. Y. Elec. Veh. Tran.	7	7½
Am. Dist. Tel.	25	25	N. E. Elec. Veh. Tr.	3¼	3
Com. Cable	164	166	Tel., Tel. & Co. of Am.	6	6¼
Elec. Boat	13	17½	Hud. Riv. Tel.	..	..
Elec. Boat, pfd.	30	31	N. Y. & N. J. Tel.	163	160

BOSTON.

	Sept. 8.		Sept. 8.
New Eng. Tel.	..	Erie Tel.	96
Mex. Tel.	2	Gen. Elec., pfd.	139
Westing. Elec.	46½	Am. Tel. & Tel.	142½
Westing. Elec., pfd.	63	Ed. Elec. Lt.	..

PHILADELPHIA.

	Sept. 8.		Sept. 8.
Elec. Stor. Bat.	70	Phil. Elec.	..
Elec. Stor. Bat., pfd.	..	Pa. Elec. Veh.	..
Elec. Co. of Am.	9⅜	Pa. Elec. Veh., pfd.	..
Gen. Elec. Auto.	..	Am. Rys.	..

BROOKLYN RAPID TRANSIT.—The Brooklyn *Eagle* devotes a column to the alleged political plot against B. R. T., saying that the Wall Street end of the Tammany leaders' campaign "may be said to have already begun." One estimate of the cost of putting the entire trolley system underground is between $3,000,000 and $4,000,000. Railroad men are quoted as saying it would ruin the company financially to be forced to do this in a short period, and some lawyers believe the company could easily defeat such legislation in the courts. The plot is said to be inspired by the activity of A. N. Brady and Wm. F. Sheehan in the present fight in Democratic circles. Both men are said to be exerting all their influence against Croker.

THE NATIONAL TELEPHONE & TELEGRAPH COMPANY.—It is explained from Philadelphia that the delay in perfecting the organization of the National Telephone & Telegraph Company is due to the magnitude of the enterprise. The formation of a $50,000,000 corporation, which will possibly control $100,000,000 or more of property, it is further stated, calls for care and deliberation. Capable men are needed to assume charge of the different parts of the work, men who will have the necessary tact and at the same time be aggressive. Most of those having the desired qualifications are already filling useful positions, and some shifting around may be necessary to obtain the men needed for the new positions.

DIVIDENDS.—The Commercial Cable Company has declared a quarterly dividend of 1¾ per cent, payable Oct. 1. The Westinghouse Electric & Manufacturing Company has declared a quarterly dividend of 1¾ per cent on its preferred stock, payable Oct. 1. American Steel & Wire Company has declared a regular quarterly dividend of 1¾ on preferred and 1¾ on common.

Commercial Intelligence.

THE WEEK IN TRADE.—On the whole, the developments in trade during the past week were favorable, and the improvement noted in general distributive business in the latter part of August has gathered force in the first week in September. Leading features have been the expanding fall trade in nearly all points West, South and on the Pacific Coast. Some improvement is noted in the Eastern jobbing demand, and there is increased Southern buying. There is also noted an improved export demand for American products, according to Bradstreet's reports, notably among them being wheat, iron and steel and cotton. The industrial outlook has been improved by settlement of the tin-plate scale, the general resumption of operations in the glass industry, the satisfactory settlement of the remaining iron and steel wage scales, and the possibility that recent large sales of print cloths will avert a resort to wage reductions in the New England cotton mill industry. The anthracite coal trade outlook is, however, clouded by the prediction that 140,000 men will strike this week. Gross earnings of all roads in the United States reporting for August to date are $23,623,357, an increase of 7.9 per cent over last year and 24.3 per cent over 1898. There is some tendency to improvement over earlier returns on many roads, and earnings for the third week are the best of the month. There was some activity in one or two of the copper stocks, but, as a whole, the copper shares were not active, although the prices of those issues were fairly well maintained. Lake copper was firm at 16¾c.

EXPORTS OF ELECTRICAL MATERIAL.—The exports of electrical material from the port of New York for the week ending Aug. 29 were as follows: Argentine Republic—20 cases electrical machinery, $626; 56 cases electrical material, $1,187. Antwerp—82 packages electrical material, $6,695. Alexandria—3 cases electrical material, $150. British West Indies—19 cases electrical material, $80. Bremen—1 case electrical material, $24. British East Indies—19 cases electrical material, $894. Bath—1 case electrical material, $110. Bristol—32 cases electrical machinery, $5,000. British Australia—19 cases electrical material, $409. British Possessions in Africa—9 cases electrical machinery, $1,425; 107 packages electrical material, $13,101. Brazil—31 packages electrical material, $2,012; 17 packages electrical machinery, $1,128. Central America—84 cases electrical material, $1,417. Chili—3 cases electrical material, $316. Cologne—7 cases electrical material, $525. Cuba—65 cases electrical material, $1,698. Ecuador—2 cases electrical material, $26. Glasgow—6 packages motors, $200; 13,085 packages electrical material, $66,526; 58 packages electrical machinery, $4,348; 2 electric launches, $1,000; 56 reels electric cable, $19,951. Havre—120 cases electrical machinery, $4,202; 138 cases electrical material, $21,245; 1 box motors, $40. Hull—14 packages electrical material, $850. Japan—9 cases electrical material, $737. Liverpool—50 packages electrical machinery, $7,700; 80 cases electrical material, $6,354; 16 packages motors, $3,300; 12 packages motor trucks, $1,386; 4 cases automobiles, $900. London—52 cases electrical machinery, $2,234; 249 cases electrical material, $9,374; 15 cases motors, $2,987; 4 cases motor cars, $250. Mexico—136 packages electrical material, $7,912; 17 cases electrical vehicles, $3,718; 36 cases electric motors, $6,216. Manchester—36 packages electrical material, $4,010; 20 packages electrical machinery, $3,675. Newcastle—35 boxes electrical machinery, $4,700. Peru—11 packages electrical material, $678. Preston—24 packages motor trucks, $1,386. Puerto Rico—124 packages electrical material, $542. Rotterdam—5 cases electrical material, $75. Reval—39 cases electric motors, $6,993. Southampton—10 packages electrical machinery, $1,201; 27 packages electrical material, $2,132. St. Petersburg—34 packages electrical material, $1,200. Trieste—1 box electrical material, $51. U. S. Colombia—20 cases electrical material, $490. Venezuela—1 case electrical material, $12. The exports for the week ended Sept. 5 were: Argentine Republic—339 packages electrical material, $783; 15 motor cars, $26,050; 167 cases electrical machinery, $20,656. Antwerp—39 packages electrical material, $4,753; 6 packages electrical machinery, $855. Brussels—2 cases electrical material, $390. British West Indies—10 packages electrical material, $475. British East Indies—16 cases electrical material, $1,150; 6 packages electrical machinery, $1,000. Brazil—8 packages electrical machinery, $451; 18 packages electrical material, $575. British Australia—20 cases electrical material, $520. British Guiana—2 packages electrical machinery, $250. Berlin—3 cases electrical machinery, $775; 3 crates automobiles, $381. Cuba—40 cases electrical material, $783; 1 case motors, $15. China—5 barrels electrical material, $200. Central America—30 packages electrical material, $380. Chili—26 packages electrical material, $1,308; 9 packages electrical machinery, $228. Dundee—1 case electrical machinery, $133. Ecuador—2 packages electrical material, $38. Glasgow—43 cases electrical material, $17,705; 70 reels electric cable, $13,454. Hamburg—102 packages electrical machinery, $3,430; 25 cases electrical material, $8,280. Havre—150 cases electrical material, $5,072; 1 package electrical machinery, $20. Hong Kong—21 packages electrical material, $392. Japan—65 cases electrical machinery, $3,150; 166 packages electrical material, $3,042. Liverpool—21 cases electrical machinery, $17,000; 28 cases electrical material, $1,280; 75 trolley poles, $2,200. London—178 cases electrical machinery, $11,559; 28 cases electrical material,

$3,906; 47 cases motors, $6,364; 25 reels electric cable, $4,072; 150 trolley poles, $4,400. Marseilles—12 boxes electrical machinery, $65; 6 packages motor trucks, $930; 3 cases electrical material, $719. Manchester—1 box motors, $172. Moscow—4 cases electrical material, $272. Mexico—6 cases electrical material, $105. Newfoundland—7 packages electrical material, $180. Newcastle—1 case electrical material, $4. Nova Scotia—1 box electrical material, $20; 1 case motors, $25; 26 packages electrical machinery, $260. Naples—3 cases electrical material, $806. Peru—4 cases electrical machinery, $1,226; 9 packages electrical material, $187. Philippines—2 packages electrical machinery, $30. Rome—1 case electrical material, $20. Southampton —26 cases electrical material, $2,698; 3 cases electrical machinery, $171; 2 cases automobiles and parts, $2,775. U. S. Colombia—5 packages electrical machinery, $44. Venezuela—38 cases electrical material, $390.

STORAGE BATTERY CONTRACTS.—The very extensive application of the "Chloride accumulator," manufactured by the Electric Storage Battery Company, of Philadelphia, is indicated by the following list of some of the concerns which have contracted for batteries during the past two or three months: RAILWAY PLANTS—Pawtuxet Valley Electric Street Railway Company, Providence, R. I.; Brooklyn Heights Railroad Company, Brooklyn, N. Y.; Boston & Maine Railroad Company, Potomac Electric Power Company, Washington, D. C.; Metropolitan Street Railroad Company (increase), Washington, D. C.; Brightwood Railroad Company (increase), Washington, D. C.; Rhode Island Suburban Railway Company, Providence, R. I.; Bellows Falls (Vt.) & Saxton River Street Railway Company, Detroit Citizens' Street Railway Company, Union Traction Company (sixth plant), Philadelphia; Sea View Railroad Company, Wickford, R. I.; Stillwater & Mechanicville (N. Y.) Railroad Company, Glens Falls (N. Y.), Sandy Hill & Fort Edward Street Railway Company; Biddeford (Me.) & Saco Street Railway Company, Portsmouth (N. H.), Kittery & York Street Railway Company; Newton & Boston Street Railway Company, Newtonville, Mass.; New York, New Haven & Hartford Railroad Company (Forestville, Conn.; East Providence, R. I.; Brayton, R. I.); Waterville & Fairfield Railway & Light Company, Fairfield, Mass.; Keene (N. H.) Electric Railway Company, Buffalo Railway Company (Eagle Street, second battery; Cold Spring, third battery; Cold Spring, increase; Eagle Street, increase); Slack & Bro., Springfield, Vt.; Metropolitan Street Railway Company, New York; American Railways Company (Joliet, Ill.; Lemont, Ill.; Spring Forest, Ill.); Boston Elevated Railway Company, Dayton (Ohio) & Northern Traction Company (Brookville battery, Arcanum battery); Indianapolis (Ind.) Street Railway Company, Union Railroad Company (increase), Providence, R. I. CENTRAL STATION LIGHTING PLANTS—Georgia Electric Light Company, Atlanta, Ga.; Edison Electric Illuminating Company, of Boston; Cincinnati Edison Electric Company, Detroit Edison Company, Indianapolis Light & Power Company, Narragansett Electric Lighting Company, Providence, R. I. (increase); Hamilton (Ont.) Electric Light & Cataract Power Co., Cleveland (Ohio) Electric Illuminating Company (increase), Edison Electric Illuminating Company, Brooklyn, N. Y.; Pawtucket (R. I.) Electric Company, Pawtucket, R. I. (increase); Edison Electric Illuminating Company (fourteenth battery), New York. ISOLATED PLANTS—Brooklyn Disciplinary Training School for Boys, Brooklyn, N. Y.; Lying-in Hospital, New York; Mrs. F. W. Scoville, Chapinville, Conn. (increase); Joseph Milbank, Greenwich, Conn.; Howard Willets, White Plains, N. Y.; M. C. D. Borden, Red Bank, N. J.; R. C. Hooper, Manchester, Mass.; Kinney Apartment House, New York; E. S. Isham, Manchester, Vt.; Astor Apartment House, New York; Eddy Manufacturing Company, Middletown, N. Y.; U. S. Government, Fort Totten, N. Y.; C. H. Mackay, Roslyn, L. I.; Mrs. M. V. Clark, Pomfret, Conn.; Westinghouse, Church, Kerr & Company, New York.

SEATTLE ELECTRIC COMPANY.—Stone & Webster have received a telegram from Seattle announcing the formal delivery of the new franchise to the Seattle Electric Co. There were originally nine separate street railway systems, three lighting companies, one steam heat company and a gas company, each doing a certain amount of electric lighting business. In addition there were two street railway companies not in operation. Of these the Seattle Electric Company now owns 14. The properties owned and consolidated are as follows: Seattle Traction Company, Union Trunk Line, James Street Construction Company, First Avenue Cable Railway Company, Grant Street Electric Railway Company, Third Street & Suburban Electric Railway Company, Madison Street Cable Railway Company, West Street & North End Electric Railway Company, Green Lake Electric Railway Company, North Seattle Cable Railway Company, Burke Block Lighting Company, the Union Electric Company, the Consumers' Electric Company, the Seattle Steam Heat & Power Company. The gross earnings of the consolidated system were as follows: 1896, $487,000; 1897, $537,000; 1898, $747,000; 1899, $874,000. If the present rate of increase is continued the 1900 earnings will be over $1,000,000. The company will have $3,735,000 first mortgage bonds: $1,250,000 preferred stock, and $5,000,000 common stock, which securities are largely owned in Boston.

INDEPENDENT TELEPHONY.—Plans are about completed by the Keystone Company, of Philadelphia, for an enormous telephone system. The plans are for four exchanges of about 7000 numbers each, and an immense subway system. Common battery, or one battery located at each exchange, will be adopted, and the system will be in every way an up-to-date, model telephone system. Dr. Louis Duncan, of the firm of Duncan & Browne, Baltimore, is personally superintending the plans. Work on the plant of the Maryland Telephone Company, Baltimore, is being rushed along as fast as the construction of the municipal subway will permit. Four exchanges have been completed, with an aggregate capacity for 8500 telephones. This company, which is the successor of the old Home Telephone Company, has now about 5100 subscribers signed up for five years. It hopes to begin the installation of instruments by the first of November next. Mr. Sidney Hand Browne, of Duncan & Browne, Baltimore, is consulting engineer of the company, and is responsible for the completeness of the system, which is a model plant.

BOSTON NAVY YARD.—The new power plant will be of considerable proportions. Both the pneumatic and electric plants are to have all the latest devices for economizing labor. The Babcock & Wilcox Company is to furnish and set up the four boilers of 300 horse-power each. Space will be reserved for additional boilers. This company will also build a smokestack 150 ft. high. The amount of their contract is $21,000. The pneumatic plant includes two air compressors of 500 ft. capacity, one hydraulic accumulator of 1000 lbs. pressure, condensers, pumps and feed-water heaters. The contract for furnishing and setting up the pneumatic appliances is in the hands of the New York Air Compressor Company, and calls for the payment of $15,000. The electrical outfit will cost $59,000, and will be put in by the Westinghouse Electric Company. There will be three dynamos of 350-hp capacity, and space for two more will be reserved.

BULLOCK ENGINES.—The month of August has been a prosperous one for the M. C. Bullock Manufacturing Company, Chicago. During the month the company shipped a hoisting plant to the Mesaba range, and another to an Illinois coal mine. Among other shipments were an 800-hp, cross-compound Corliss engine to Akron, Ohio; four large engines and compressors to Australia; diamond drills to Chili, Turkey, Southern California, Spain, British Columbia and the State of Washington. Among other recent contracts is one for two engines of the Willans type, for the Chicago Electric Traction Company—one to be a four-line engine with a four-throw crank to develop 600 horse-power, direct-connected to a generator; the other a three-line engine of 175 horse-power, to run a booster.

ELECTRIC POWER AT KIEL.—Consul-General Guenther writes from Frankfort, July 14, 1900: "Steam power is to be superseded by electricity to a very considerable extent in the Government dockyard at Kiel, Germany. After experimenting with electric-power transmission on a comparatively small scale, the administration has now decided upon a bolder scheme, whereby all the machine tools, etc., installed in the different workshops, are to be electrically driven. To this end a power plant, having a capacity of 3,500 horse-power, is to be erected. This plant will also supply electrical energy for driving the powerful dockyard pumps.

METROPOLITAN'S NEW CAR BUILDING.—A. V. Porter, architect for the Metropolitan Street Railway Company, New York City, has filed plans calling for an expenditure of $35,000 for proposed improvements to the car stable and power house on the west side of Eighth Avenue from Forty-ninth to Fiftieth Streets. The building will be altered internally so as to divide the structure, one-half being for the storing of cars while the other half will be turned into a station for charging electric automobiles.

MACHINERY FOR CUBA.—The United Fruit Company, at Banes, Cuba, has closed a contract through Mr. Percival R. Moses, consulting engineer, 35 Nassau Street, New York, for the equipment for a sugar plant. The order for the boilers went to the Clonbrock Steam Boiler Company, of Brooklyn; the three engines, to be direct-connected to General Electric generators, will be supplied by McClave, Hamilton & Rimmer, 85 Liberty Street, and the switchboard by the Northern Engineering Company, 39 Cortlandt Street.

THE SNOQUALMIE FALLS POWER COMPANY, of Seattle, Wash., has contracts for the entire output of its generating station, and is contemplating putting in a duplicate of the present plant. The plant now supplies current to Tacoma and Seattle. The transmission line is approximately 50 miles in length, and when the plant is enlarged the lines will be extended to Everett, a distance of 40 miles more. The present transmission lines are aluminum.

MESSRS. McCLAVE, HAMILTON & RIMMER, 85 Liberty Street, New York, have been awarded a contract for a high-speed engine, direct-connected to a 50-kw generator, for addition to the existing plant in the Cotton Exchange Building, New York.

General News.

THE TELEPHONE.

STANWOOD, IA.—A company is to be organized to build a telephone line between Stanwood and Olin.

WINNIPEG, MAN.—The long-distance telephone has been put in operation between this city and Brandon.

LOCKPORT, ILL.—The People's Telephone Company, of Lockport, has filed notice of increase of capital stock from $12,000 to $15,000.

CHARLOTTE, N. C.—The four C's Company is having a survey made of a proposed extension to run about two miles out from this city.

BALTIMORE, MD.—The plant of the Maryland Telephone Manufacturing Co., which was destroyed by fire recently, will be rebuilt at once.

HENDERSON, N. C.—The Henderson Telephone Company is still extending its lines and establishing exchanges throughout Eastern North Carolina.

APPLETON, WIS.—The Wisconsin Telephone Company has asked permission of the Common Council to place all its wires in the city underground.

ADVANCE, IND.—The Advance Telephone Company has been incorporated. Capital, $2,000. Incorporators: T. M. Shera, J. M. Sandy, M. P. Riness, W. D. Leap, L. A. Dean, all of Advance.

SPRINGFIELD, ILL.—The F. E. Bell Telephone Company, of Des Plaines, has been incorporated. Capital stock, $10,000. Incorporators: Frank E. Bell, Edward A. Manuel and William Nunn.

RIDGEVILLE, IND.—The Ridgeville Telephone Company has been incorporated. Capital, $8,000. Incorporators: S. C. Long, R. O. Fraser, D. G. Heister, M. T. Sumptein, all of Ridgeville.

PHILADELPHIA, PA.—The Bell Telephone Company, of this city, is having plans prepared for the erection of a large branch office building at Fifty-second Street and Lancaster Avenue.

WILMINGTON, DEL.—The Delmarvia Telephone Company, of Wilmington, has made a connection with the West Chester (Pa.) Telephone Company, which gives connection with about 27 Pennsylvania towns.

MILWAUKEE, WIS.—Articles of incorporation were filed by the Farmers' Telephone Construction Company, capitalized at $500,000. Charles Sawtell, A. N. Redfield and Martin Mayland are the incorporators.

ALBANY, N. Y.—The Springville Telephone Company, of Springville, Erie county, with a capital of $3,000, has been incorporated. The directors are: M. N. Brooksell, F. D. Smith and A. A. Churchill, of Springville.

ROCHESTER, N. Y.—The city has been paying the Bell Telephone Company $5 a year for the patrol box telephones. The recent bid of the Rochester Telephone Company at $3 per instrument was accepted and the award made.

NEW AUGUSTA, IND.—The Independent Telephone Company, New Augusta, has been incorporated. Capital, $10,000. Incorporators: M. J. Nagle, W. Johnson, W. B. McDonald, J. Harcourt, G. T. Avery, all of New Augusta.

WELLSBORO, PA.—The Wellsboro & Gaines Telephone Co. has been incorporated. Capital, $2,000. Incorporators: D. P. Shumway, M. P. Howe, S. L. Campbell, G. E. Hall, all of Delmar; A. R. Niles, E. Watson, Jr., both of Wellsboro.

COLUMBUS, OHIO.—The Stark County Telephone Company, of Canton, was incorporated last week with a capital stock of $100,000. The company will build an exchange in President McKinley's home city with lines radiating throughout the county.

PITTSBURG, PA.—The Central District & Printing Telegraph Company has completed the plans for an addition to its East End station. The annex will be 20 x 40 feet, and three stories high. The contract for the erection of the building will be let within a week.

LOUISVILLE, KY.—The General Council adopted the ordinance authorizing a franchise for natural gas illuminating purposes. The ordinance is aimed at the gas company, whose exclusive frachise runs for 16 years. It also adopted an ordinance authorizing a sale of telephone franchise. Two companies want the franchise.

MANITOWOC, WIS.—The City Council on Aug. 27 passed a resolution requesting the Wisconsin Telephone Company to put all its poles now on Eighth Street inside the curb, on account of the paving which is now being done there. As a result, all work being done here by the telephone company has been suspended for the present. The company had started virtually to rebuild the system. Over 7000 feet of cables and a new submarine cable are among the improvements.

BOSTON, MASS.—It is reported that the sub-companies of the Erie Telephone system increased their net earnings over 41 per cent for the six months ending June 30 over the corresponding six months of last year. The gross income for the year 1900 will exceed $5,000,000 as compared with $3,600,000 for the year 1899. The Erie's proportion of the net earnings is at the rate of 9 per cent on the capital employed and will average for the year the same as last year, namely, 10 per cent, after deducting all interest and fixed charges.

PITTSBURG, PA.—The Pittsburg and Allegheny Telephone Company is nearing completion of its plant in the cities of Pittsburg and Allegheny. About 2000 telephones have been put in service. They have over 7000 subscribers signed up for five years, and the instruments are being put in at a rate of about 150 per day. Common battery, multiple boards, upright pattern have been adopted throughout. Mr. Sydney Hand Browne, of the firm of Duncan & Browne, Baltimore, has personally supervised the work from the beginning.

SHEBOYGAN, WIS.—Judge Kirwin has decided the case of the Wisconsin Telephone Company vs. The City of Sheboygan, in favor of the city. The telephone company occupied the streets of the city and commenced work on extension of its lines when the city stopped it by injunction. The company was offered a franchise which it would not accept. A demurrer was entered by the company, the city being asked to show cause why it should not grant the company a franchise acceptable to it. This demurrer was not sustained. The company claimed that, it having a State license to occupy public highways, the Council could not prohibit it entering the city, but might regulate it in the streets.

ELECTRIC LIGHT AND POWER.

MARIETTA, OHIO, is increasing its steam and electric plant.

FALLS CHURCH, VA.—There is an opening for an electric light plant here.

LAKEWOOD, OHIO, has just purchased a 150-kw Westinghouse alternator and will install alternating arc lamps.

MANTORVILLE, MINN.—The power house of the Kasson electric light plant was burned to the ground recently.

IOWA FALLS, IA.—The electric light and power company at Iowa Falls will reorganize, and its capital stock in the future will be $40,000.

HICKORY, N. C., has been in total darkness for nearly two months on account of a hitch between the city and the electric light company.

MANCHESTER, N. H.—Wallace D. Lovell, of the local street railway, has purchased the plant of the Portsmouth Electric Light & Power Company.

GALESBURG, ILL.—The City Council of Galesburg has decided to build a municipal electric lighting plant. The plant is to be completed in 90 days.

PORT ARTHUR, TEX.—The plant of the Port Arthur Electric Light Company was totally destroyed by fire recently. The loss is $12,000; insurance, $9,000.

CONCORD, N. H.—F. W. Landon & Co., of this city, have been awarded the contract to install the new electric lighting plant in the Dustin Island woolen mill in Penacook.

SPRINGFIELD, ILL.—The Citizens' Electric Company, of Clinton, Ill., has been incorporated with a capital of $15,000. The incorporators are E. S. Nixon, Titus Hinchcliffe and W. W. Newman.

JACKSON, GA.—W. F. Smith, of Flovilla, and others are interested in a company that has purchased the Thomas shoals on the Ocmulgee river, and will utilize the power to furnish electricity to several towns.

ST. PAUL, MINN.—The Cass Water, Light & Power Company, Cass Lake, has been incorporated. Capital, $50,000. Incorporators: F. R. Green, of Fredonia, N. Y.; R. H. Hartley and H. Hartley, both of Cass Lake, Minn.

WAPAKONETA, OHIO, has just purchased a 200-kw Fort Wayne high frequency alternator, together with a very elaborate switch-board and instruments. This addition to the city's plant will give the village a capacity of 6000 cp lamps and 120 arcs, all Fort Wayne apparatus.

LANCASTER, PA.—The York Furnace Electric Company, Lancaster, has been incorporated. Capital, $1,200. Incorporators: F. Shoff, of Colemanville; J. W. Holman, of Lancaster; N. J. Miller, G. B. Wilson, both of Lancaster Township; W. F. Beyer, of Lancaster City.

PEORIA, ILL.—By a contract entered into between the city of Peoria and George Macomber, representing the Peoria Gas Light & Coke Company, the city is to receive all-night electric light service at the rate of $65 per year for each light. The lights are to burn every night.

FORT RECOVERY, OHIO, has awarded its contract for new electric light plant to W. P. Nagel, of Toledo. There will be a 50-kw high frequency alternator, with three alternating arc lamps. The electric apparatus to be used is from the Fort Wayne Electric Works, Fort Wayne, Ind.

HARRISBURG, PA.—The New Kensington Electric Light, Heat & Power Company, New Kensington, has been incorporated. Capital, $75,000. Incorporators: T. M. Conville, G. A. Coleman, both of Steubenville, Ohio.; J. G. Ingham, of Allegheny; G. H. Calvert, of Etna; C. W. Reamer, of Duquesne.

BALTIMORE, MD.—The Park Board will at its next meeting consider the question of erecting an engine and dynamo in the power-house at Druid Hill Park for the purpose of providing lights in that park. The cost of the machinery and the wiring of the park would be about $10,000, it is estimated.

COUNCIL BLUFFS, IOWA.—The Bluffs City Electric Light and Gas Company was granted a franchise for 25 years over the Mayor's veto, also a contract for five years for electric lights for the city streets. Thomas Bowman is manager. This calls for a special election, to be held Oct. 16, for a vote of the people.

SAYVILLE, L. I.—The Sayville Electric Light, Heat & Power Company, which is capitalized for $15,000, has closed a contract with Hewitt & Worden, of Newburgh, N. Y., for the erection of a plant to light this village. The electrical equipment will be furnished by the Edison General Electric Company. It will furnish a street lighting circuit of 83 lights of 25-cp each.

SAN FRANCISCO, CALIF.—The Public Utilities Committee decided to recommend that the city make a contract to purchase a lighting plant to be paid for in 20 annual instalments. It is known as the Ridley plan, and the plant will cost $1,000,000. The guarantee is that the city will be lighted better than at present for $294,000 a year, and in 20 years the plant will belong to the city.

HOUSTON, TEX.—The Citizen's Electric Light Company is arranging to put in a sufficient additional amount of machinery, engines, boilers and dynamos to increase the power of the plant 1000 hp and add 10,000 additional incandescent lights. These additional facilities will be completed about Oct. 15 and will give the plant a total incandescent lighting capacity of 15,000 lights. These lights will be offered to patrons at ½ cent per lamp per hour.

CRISFIELD, MD.—The Crisfield Ice Manufacturing Company, of Somerset county, has been granted a 20-years' franchise for an electric light plant in the town of Crisfield, Md., and has entered into a five-year contract to have lamps turned on by Jan. 1, 1901. The company is now ready to receive bids for a 75-kw alternating-current generator, with plant complete or boiler and engine separate, by Sept. 15. All machinery f. o. b. Crisfield, Md. Address all communications to John H. Fontaine, secretary and treasurer.

THE ELECTRIC RAILWAY.

WILMINGTON, DEL.—The Newark & Granville Street Railway Company of Newark, Ohio, capital stock $300,000, has been incorporated here.

BLANCHESTER, OHIO.—Several capitalists of this place and vicinity contemplate building an electric road from Marysville, Ky., north through Georgetown, Brown county, Blanchester, Morrow, to Franklin and possibly to Dayton.

FRANKFORT, KY.—The Ohio Valley Electric Railway Company, to operate an electric road from Huntington, W. Va., to Ironton, Ohio, filed articles of incorporation. Capital, $1,000,000. Thos. J. Ryan and others, of Huntington, are incorporators.

MILFORD, MASS.—The Milford, Holliston & Framingham Street Railway Company, one of the competitors for a franchise from Milford to the Hopkinton town line, is to reduce the fare between Milford and Hopedale provided the company secures a franchise as applied for to North Purchase.

TRENTON, N. J.—Another large trolley deal contemplates a line between New York and Harrisburg, which, it is said, is to be the connecting link for a proposed trolley line between Boston and Washington. J. F. Shaw & Co., of Boston, is reported to be engineering the deal, and has already started to build a line between here and Philadelphia.

DALLAS, TEX.—The Coffenberry-Bishop syndicate of Cleveland, Ohio, has purchased two electric street railway lines in Fort Worth—the City Street Railway and the Fort Worth Street Railway—for approximately $400,000. The syndicate's Fort Worth lines and its lines in Dallas will be connected by 32 miles of road to be built between the two cities at a cost of $1,000,000.

ROCHESTER, N. Y.—The Sodus Bay Electric Railway, connecting Sodus, on Lake Ontario, with Rochester, was opened to the public on Aug. 22, 500 members of the Order of the Mystic Shrine conducting the ceremony. The first car was surrounded by the Shriners, and George Loder, standing at the head of the car, said: "In the name of Allah and Mohammed, his prophet, I do now christen you, Sodus Bay Railway, Margaretta. No harm nor accident shall come to any one connected therewith. Aug. 22, 1900."

LORAIN, OHIO.—A lively electric railway war is on in this city. Some time ago the council granted a franchise to the Cleveland, Elyria & Western Electric Railway Company for a single-track line on West Erie Avenue. A franchise was also given to the Sandusky & Interurban Railway, which is an extension of the Lorain & Cleveland line, for a double-track road on the same street. At a meeting of the companies and the city officials no agreement could be reached as to which company should build the tracks and own them, or which should occupy the centre of the street. Last Friday night the Sandusky line people placed several hundred men at work, and in two hours had laid a double track road from the centre of the city to the town line. Saturday the Cleveland, Elyria & Western people laid a third track at the side of the street. They will also attempt to oust the Sandusky line on the ground that its franchise does not take effect until June 4. The City Council is trying to find a way out of the dilemma.

THE AUTOMOBILE.

AN AUTOMOBILE CHARGING STATION.—Extensive alterations will be made to the car barns of the Metropolitan Street Railway on the west side of Eighth Avenue, between Forty-ninth and Fiftieth Streets, New York. A feature of the alterations will be the providing of a place where electric vehicles may be recharged. The cost of the improvements will be about $35,000.

THE PACIFIC MOTOR VEHICLE COMPANY was recently incorporated, with Oakland, Cal., as the principal place of business. It is proposed to manufacture vehicles to be propelled by gasoline, compressed air, alcohol or electricity. Directors: J. T. Bradley, H. T. Bradley, J. L. Doble, J. B. McChesney and J. F. Smith, all of Oakland. Capital stock, $100,000; subscribed, $5000.

AUTOMOBILE CHALLENGE.—Mr. Alexander Winton, of Cleveland, has challenged Mr. W. K. Vanderbilt, Jr., and Captain Albert Bostwick, at Newport, R. I., to an automobile race of 100 miles on a smooth track. A cup valued at $800 will be given to the winner, provided the race is made a feature of the automobile exhibition which is to be held at Washington Park, Chicago, Sept. 18-22.

AUTOMOBILE RACES.—The first race meet of the New York Automobile Racing Association was held at Aquidneck Park, Newport, R. I., on Sept. 6. It was attended by a large crowd and the sport was of the most interesting character. The distance for the races was five miles, the best 2 out of 3. The first race was won by Mr. A. L. Riker, in his electric vehicle, in 13 m. 5 sec. The race for motor tricycles was won by Mr. A. K. Skinner in 9 m. 12 sec, and the race for steam vehicles was won by Mr. J. H. McDuffield in 10 m. 52 sec. There was also a contest between gasoline vehicles, and the race was taken by Mr. W. K. Vanderbilt, Jr., in 8 m. 53½ sec. In the championship race, Mr W. K. Vanderbilt, Jr., was the winner with his gasoline vehicle, in 8 m. 54 sec. Mr. Skinner's motor tricycle was second, and Mr. A. L. Riker's electric vehicle came in third, making the distance in 8 m. 28½ sec.

OBITUARY.

ABDANK-ABAKANOWICZ.—The sudden death is announced, from Paris, of M. Bruno Abdank-Abakanowicz, at his villa near that city. He died of heart failure. Mr. Carl Hering writes that he was perfectly well and joking with friends in his garden five minutes earlier. He was a Pole by birth and only about 45 years of age. He was well known in this country, which he had visited, and served as one of the United States jurors of awards at the Paris Exposition of 1889. He was a director in the original French Thomson-Houston Company and was very successful in introducing American electrical apparatus in Europe, becoming also a director in companies in Italy and elsewhere. At the time of his death he was engaged in various experimental work and took much delight in gardening. At all times a most charming companion and speaking all the civilized languages of Europe, he had a host of friends and acquaintances. He leaves an unmarried daughter.

PERSONAL.

L. B. Stillwell.

MR. L. B. STILLWELL, Electrical Director of the Niagara Falls Power Company, has resigned his position with that company and removes to New York City, where he will open an office as consulting electrical engineer. Mr. Stillwell has been connected with the Niagara Falls Power Company's electrical interests practically since their inception, having met Mr. Edward D. Adams, president of the Cataract Construction Company, and Dr. Coleman Sellers, afterwards president and chief engineer of the Niagara Falls Power Company, in London in 1889, when they were making their preliminary investigations of the possibilities of hydro-electric utilization of Niagara. At that time Mr. Stillwell became greatly interested in the Niagara project, and subsequently, as electrical engineer and assistant manager of the Westinghouse Electric and Manufacturing Company, he supervised the design, construction and installation of the electrical machinery constructed by that company for the Cataract Construction Company. In March, 1897, he left the Westinghouse Company to become electrical director of the Cataract Construction Company and of the Niagara Falls Power Company, and has since that time made his headquarters in Niagara Falls, where he has had entire charge of electrical construction and of the operation of the entire plant as completed, organizing and training for the latter purpose a force whose skill, thorough discipline and effectiveness have received the approving comment of such men as Admiral Sampson and Lord Charles Beresford. A new classification of accounts, new methods of placing and tracing orders, and a system of store-room accounts, all of which have been formally adopted by the company and found highly satisfactory in practice, are among the results of his work. The installation of the first 50,000-hp plant at Niagara is now completed and the plant in successful commercial operation. Plans for a second electrical installation of 55,000-hp are finished, and specifications issued, and it is expected that for several years no radical change in the type of apparatus at Niagara will be made. For the past two years Mr. Stillwell has given a large part of his attention to consulting work for other electrical enterprises, notably the equipment of the elevated railway of the Manhattan Railway Company in New York City, which is proceeding under his direction. Following Mr. Stillwell's departure from Niagara, Mr. Philip Price Barton and Mr. Paul M. Lincoln, assistant superintendents, have been promoted, Mr. Barton having been appointed superintendent of the operating department of the Power Company, and Mr. Lincoln resident electrician. These gentlemen have demonstrated by excellent work under Mr. Stillwell their fitness for the positions of high responsibility which they now assume. The engineering staff of the company and its allied interests, including the Cataract Power and Conduit Company, of Buffalo, and the Tonawanda Power Company, has been strengthened by the appointment of Mr. Harold Winthrop Buck as electrical engineer. Mr. Buck is a graduate of the Sheffield Scientific School and received his degree of electrical engineer from Columbia University. For the past five years he has held an important position on the engineering staff of the General Electric Company at Schenectady. Mr. Stillwell will retain a connection with the Niagara Falls Power Company as consulting electrical engineer. For the present his office will be at 32 Park Place, New York.

MR. LOUIS W. EMERICK, president of the Syracuse Arc Lamp Company, has been in New York during the past week on the affairs of the company, which is pushing its business in this quarter.

MR. ARTHUR WRIGHT, on his way home from Australia, passed hurriedly through this city last week, catching the Cunarder for Liverpool. It will be remembered that his associate, Mr. Reason, was killed in Australia by being thrown from his horse. Many of Mr. Wright's friends here were very sorry his stay was so limited.

MR. LYMAN C. REED, vice-president and general manager of the Safety Electric Manufacturing Company, of New Orleans, has been in New York City on a general visit North. He has for some time past been connected with the Edison Company of New Orleans. His new company will make an electric heater of novel type, and handle various specialties.

MR. T. F. BECHTEL, secretary of the Edison Light Company of Grand Rapids, Mich., has won two prizes from *Municipal Engineering* for the best set of forms to be used in lighting and kindred account work. Prizes also went to Mr. J. R. Shutz, of the Trenton, N. J., Gas and Electric Company; Mrr. A. H. Purdy, of the Topeka, Kan., Edison Company, and Mr. L. A. Dillingham, of the Coldwater, Mich., Board of Electric Light and Water Works.

MR. PAUL W. BOSSART, who has been prominently identified with the American Electric Telephone Company for a number of years, has accepted an important position with the Kellogg Switchboard and Supply Company. He is one of the pioneer and progressive telephone engineers of this country. His experience in various lines of applied electricity includes telegraphy, electric lighting by storage battery, electric railway work, and nearly two years in Mr. Edison's laboratory, besides about ten years' service as district and general superintendent for companies operating under Bell licenses.

MR. H. M. SAYERS, power engineer to the British Electric Traction Company, Ltd., has been visiting some of the large electrical undertakings in this country, accompanied by members of the staff. He and his colleagues have visited several of the Eastern cities and met with an extremely cordial reception. They were very much gratified to find that not only were their requests for in-

formation generously answered, but no efforts were spared for their comfort or to let them see whatever was worth while in each place. They have just returned home, after a most enjoyable and instructive tour.

Trade Notes.

THE LITOFUGE MANUFACTURING COMPANY, formerly at 1710 Market Street, Philadelphia, Pa., has moved to 2240 North Ninth Street, where it has larger and more commodious quarters.

ELECTRICAL EQUIPMENT WANTED.—Walton Brothers, Cleveland, Ohio, are preparing to erect a large power block. Considerable electric equipment will be required. Barnum & Company, architects, are preparing the plans.

OIL FILTERS IN ALASKA.—The Alaska Treadwell Gold Mining Company, Douglass Island, Alaska, operating the largest stamp mills in the world, has placed a third order with the Burt Manufacturing Company, of Akron, Ohio, for oil filters.

THE DICKE TOOL COMPANY, of Downers Grove, Ill., has been awarded a bronze medal on tools at the Paris Exposition. Mr. Dicke was in personal attendance at the Paris Exposition, and the exhibit created considerable interest among foreign manufacturers.

"IDEAL" ENGINES.—The central station high speed type of four-ported Ideal engine is illustrated in a bulletin just issued by A. L. Ide & Sons, Springfield, Ill. Illustrations give views of the details of the valves, indicator diagrams and plans and elevation views of the engine.

DESK TELEPHONES.—The 97 desk telephone, manufactured by Couch & Seeley Company, 212 Summer Street, Boston, Mass., is fitted with C. & S. microphone and bi-polar receiver and is adapted for either battery or magneto call. This telephone is of artistic design and finished in nickel.

FALCON ARC LAMPS.—The Falcon Electric Company, 432 East Seventy-first Street, New York City, has just issued a bulletin illustrating and setting forth the dimensions and principal features of the Falcon direct current arc lamps, which were described and illustrated in these columns on Sept. 1.

THE ROLFE ELECTRIC COMPANY, Chicago, has severed its connection with the Eureka Company and terminated the licenses which the Eureka Company held under its patents. The Rolfe Company will continue the protector business and is prepared to fill orders for the several styles of protectors which it handles.

LOCUST PINS AND BRACKETS.—Some facts worth knowing are given about locust pins and brackets for electrical construction in a pamphlet just issued by the Blue Ridge Locust Pin Co., Asheville, N. C. This company turns out 60,000 pins and brackets a day, and, having factories in several States, is able to ship from the point nearest the customer.

"NOXALL" ANNUNCIATORS.—An unprecedented demand for the "Noxall" annunciator is reported by the Western Electrical Supply Company, St. Louis, Mo. This company, on account of the large increase in floor space in its new building, just erected at Seventh Street and Clark Avenue, has taken advantage of the situation and is now carrying one of the largest stocks of annunciators in the United States, including the "Ross & Rival" annunciators.

DROP IN ALTERNATING CURRENT LINES.—A pamphlet just issued by the Westinghouse Electric and Manufacturing Company contains a reprint of an article by Ralph D. Mershon entitled "Drop in Alternating Current Lines." This is supplemented by a short description of the Westinghouse Type F compensator. The pamphlet is carefully produced and contains excellent illustrations on the subjects treated.

PARIS AWARD.—Messrs. Binney & Smith, 81 Fulton Street, New York, have been awarded the gold medal by the Jury of Awards at the Paris Exposition for its exhibit of carbons. The firm had an exhibit of enclosed arc carbons of the different manufacturers in the United States which had been made from the crude carbon produced by it. It also had samples of carbons used for insulating purposes and for coating tapes and wires.

ELECTRIC HOISTING PLANT.—The Westinghouse Electric and Manufacturing Company recently closed a contract with the Black Diamond Coal Company for an electric hoisting plant for the company's mines near Seattle, Wash. The plant will be installed 1350 ft. from the surface. It will hoist 4-ton coal cars 2650 ft. on a 30-degree slope at the rate of 600 ft. per minute. The contract calls for a 250-kw generator, a 200-hp hoist motor, switchboard apparatus, etc.

AUTOMOBILE SUPPLIES.—A catalogue of automobile running gears, engines, supplies, etc., has just been issued by the St. Louis Automobile & Supply Company, Twenty-third and St. Charles Streets, St. Louis, Mo. The catalogue contains 32 pages, and is very completely illustrated. This company also manufactures complete gasoline and electric vehicles. It claims to be the first company in the world to start an automobile supply business, and the catalogue indicates that it has started on a large and complete scale.

TRANSFORMER TESTING.—In a 46-page pamphlet recently issued by the General Electric Company, instructions are given for the few simple tests required for the determination of transformer efficiency with the use of instruments and apparatus available at a central station. The subject is well illustrated. The pamphlet also gives considerable practical information on the general subject of transformers and contains a description of the General Electric Type H transformer, which was described and illustrated in these columns on Aug. 4.

NEW ARC LAMP.—The Jandus Electric Company is putting a new alternating arc lamp on the market. One of the improvements is the new arrangement of winding; voltage loops for low frequency are placed on one-half of the coil, and those for high frequency on the opposite side. The adjustment for change of frequency or voltage is effected by a single conductor and connector attached to the proper voltage loop on the proper side of the coil. A new bulletin has just been issued, which, with the catalogue, may be had on application. The Chicago office is at 1537 Monadnock Building.

THE CALCULAGRAPH.—This interesting instrument, which is designed to record by mechanical means the time consumed in a toll conversation over a telephone wire, is fully illustrated in a neat pamphlet just issued by the Calculagraph Company, 9 Maiden Lane, New York City. The Calculagraph is used by the Bell Telephone Company in all of the larger cities throughout the country and in European exchanges, as well as in telephone exchanges in Japan. Its construction, as well as its application to telephone switchboards, is clearly illustrated. The pamphlet contains a list of exchanges in which the instrument is used.

HIGH POTENTIAL INSULATORS.—Mr. Fred M. Locke, Victor, N. Y., has just issued his annual illustrated catalogue of porcelain and glass insulators, steel pins with porcelain bases, and line material of all kinds for high voltage power transmission. The pamphlet contains a list of plants using Locke insulators. The illustrations show the various types of insulators manufactured by Mr. Locke, both porcelain and glass, many of which have been illustrated in the columns of ELECTRICAL WORLD AND ENGINEER at different times in the past. An interesting illustration shows a pile of 18,000 No. 316 "Victor" insulator tops; another view shows the testing room and the manner of subjecting "Victor" insulators to a brine test of 120,000 volts for actual line voltage of 60,000.

THE RE-NEW LAMP COMPANY, Boston, Mass., reports that it is at present supplying about 75 per cent of the isolated plants of New England with renewals of their incandescent lamps, and many of the central stations are also on its list. Business with all the principal concerns in all the States east of the Mississippi River is also reported. With a capacity of some 6000 lamps a day and the immense stock of burned out lamps, the company claims to be able by careful selection and sorting to fill large orders and do satisfactory work. Although it can take care of orders for any candle power, it has thought it prudent for the time being to confine its output to 16-cp lamps only. The company purchases for cash burned-out lamps. The management is under control of gentlemen of high standing and business capacity.

TELEPHONE CATALOGUE.—Bulletin No. 1, a new circular issued by the Kellogg Switchboard and Supply Company, Chicago, describing the numerous new designs in telephones and telephonic apparatus manufactured by it, has just reached this office. The pamphlet is very handsomely gotten up and has about 20 pages, illustrated by 15 excellent half-tone cuts. The parts of a telephone are discussed in detail, sections being devoted in turn to receivers, transmitters, transmitter arms, the hook-switch, magneto generators, and the ringer. The Kellogg standard series and bridging telephones for all kinds of service, and also desk and cabinet telephones are fully described. These telephones are made for use with the magneto, local battery or common battery systems, as desired by customers. The principles of the Kellogg divided exchange system and the line of small and compact telephones especially adapted to common battery work are also taken up. The distinguishing feature of the Kellogg circular is its readability, its pages containing a large amount of information in attractive form concerning the construction of telephonic apparatus and appliances, which will make it interesting alike to the telephone expert and non-technical reader.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 4, 1900.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

657,104. METHOD OF STRINGING OR SUPPORTING ELECTRICAL CONDUCTORS; L. Hackethal, Hanover, Germany. App. filed April 20, 1900. This invention relates to the construction and mounting of overhead electrical conductors and comprehends the use of insulated wires and the support of the same upon the pole or cross-arms by means of insulators of ordinary character, there being two wires attached to each insulator and upon opposite sides thereof, the said wires crossing each other midway between the poles, so that the wire which on one pole is attached to the front of the insulator is on the next succeeding pole attached to the back of the insulator. In this way the number of insulators necessary is decreased by one-half, and inductional influences are suppressed.

657,119. PROCESS OF REFINING COPPER FROM SOLUTION CONTAINING ANTIMONY AS AN IMPURITY; F. Klepetko and J. T. Morrow, Great Falls, Montana. App. filed Jan. 18, 1898. The process consists in introducing wood-tea into a copper solution containing antimony as an impurity, and then subjecting the solution to electrolysis and depositing the copper in a purified state.

657,159. RHEOSTAT CONTROLLER; J. Dillon, Milwaukee, Wis. App. filed June 4, 1900. This invention comprehends the use of a pivoted rheostat-arm having a weight in connection therewith, and a fluid-flow or other governing mechanism in gear with the same against the power of the weight. A main switch lever is in operative conjunction with a mechanism which permits the rheostat-arm to move by gravity at a time subsequent to a circuit closing operation of the main switch lever, but which restores the arm to normal position prior to a circuit opening operation of the lever.

657,165. SEWING MACHINE MOTOR ATTACHMENT; F. P. Huyck, Swanton, Ohio. App. filed June 7, 1900. This invention provides means whereby a motor may be detachably applied directly to the driving shaft of any of the sewing machines of a certain type with but little alteration in the sewing machine. There is also a bobbin winding device which may be run

by the motor independently of the sewing machine, and a combined brake and rheostat arrangement.

657,170. AUTOMATIC RAILWAY SIGNAL SYSTEM; J. W. Lattig, West Bethlehem, Pa. App. filed June 6, 1900. Under this invention the signal is operated by fluid pressure applied by a pump, both the pump for applying and the device for relieving the pressure being operated by electrically controlled instrumentalities automatically governing their operation by means of the usual track circuit and track relay included therein. Each signal is provided with its own pump motor and pressure controlling device, so that fluid pressure for operating each signal can be generated, applied and controlled without respect to or dependence upon the operating devices or means of any other signals.

657,196. SUBMARINE CABLE; T. Guilleaume, Mulheim-on-the-Rhine, Germany. App. filed Oct. 19, 1899. (See page 420.)

657,199. ELECTRIC LAMP FOR DENTAL PURPOSES; D. E. Lawton, Providence, R. I. App. filed Oct. 23, 1899. A shallow bowl at the end of an elongated handle contains a tiny electric lamp. The bowl is provided with a removable cover which carries a mirror, the quicksilver being removed from the edge portion thereof, so as to leave an annular clear space for the passage of rays of light from the lamp when the cover is in place.

657,202. ELECTRIC FURNACE; H. C. McBriar, Middletown, N. Y. App. filed May 13, 1899. The furnace is composed of two hinged parts, each having an electric heating circuit therein, and insulated electric connections between the circuits, the connections consisting of contact parts which are

657,104.—Method of Stringing or Supporting Electrical Conductors.

adapted to move upon each other when the hinged parts are operated, so as to maintain continuous electrical connections between the heating circuits.

657,211. ELECTRIC LOCK; H. G. Carleton, New York, N. Y. App. filed Jan. 13, 1900. The mechanism of this lock is characterized by a controller which normally engages the operative connections of the lock so as to prevent the same from moving a sliding part, the controller being operated to release the connections by the attractive force of a magnet.

657,213. TROLLEY; J. E. Connolly, Newark, N. J. App. filed Dec. 5, 1899. The trolley arm carries at its upper end a head providing bearings for a main contact wheel adapted to rotate in a vertical plane, and a pair of supplemental contact wheels adapted to rotate in a horizontal plane; the supplemental contact wheels being so disposed as to overhang the periphery of the main wheel. The peripheries of the three wheels lie in close proximity to one another and are grooved in such a manner as to practically surround the power wire.

657,221. STATIC RELAY; I. Kitsee, Philadelphia, Pa. App. filed May 20, 1899. This device is used for relaying rapidly recurring electric currents, and consists of conducting foil or leaves inserted in a partially exhausted tube. These leaves are provided with means whereby they may be connected with the terminals of an electric circuit and stand in juxtaposition to conductors which are connected to a local circuit including a battery and an electromagnetic device.

657,222. WIRELESS OR SPACE TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed May 20, 1899. This invention embodies a receiving instrument which consists of a chemically prepared paper in electrical contact with one terminal of a receiving circuit, the other terminal of the receiving circuit being separated from the prepared paper by the interposition of a non-conducting body. One terminal of the receiving station is connected to the air line and the other to the ground.

657,223. RECEIVING DEVICE FOR TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed May 20, 1899. The receiving instrument consists of a polarized and differential relay containing in one of its balances a device whose resistance is decreased through the action of the incoming high-tension impulses of electricity. A local sounding device, adapted to be actuated by the armature of this relay, opens and closes a shunt circuit which contains a resistance, and thereby restores the balance of the relay. The aerial conductor, as well as the ground wire, are connected with the relay.

657,224. WIRELESS OR SPACE TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed Sept. 18, 1899. This invention provides for a "calling up" device to be used in wireless telegraphy, and consists of a movable conductor and two contact points, forming part of the receiving circuit, one contact point being also connected to a local battery and an electromagnetic device. The other pole of the electromagnetic device is connected to the movable conductor, the second contact point being connected to the ground.

657,262. METHOD OF SETTING DIAMONDS, ETC., IN HOLDERS; G. Anderson, Carnoustie, Scotland. App. filed Aug. 29, 1899.

657,288. TELEPHONE TRANSMITTER ARM; E. R. Kennedy, Alleghany, Pa. App. filed April 12, 1900. Details of construction whereby free adjustment of the transmitter may be obtained and the wires leading thereto concealed.

657,305. MEANS FOR RELIEVING TELEPHONE LINES FROM DELETERIOUS ELECTRICAL CHARGES; Chester H. Arnold, Boston, Mass. App. filed Dec. 22, 1899. (See page 420.)

657,311. CLOSED CONDUIT ELECTRIC RAILWAY; L. Dion, Boston, Mass. App. filed March 6, 1899. A sectional upper conductor, located under ground, is provided with projections at intervals which extend above the surface of the roadway. A flexible conductor located within the closed conduit is caused to make contact with the upper conductor by a magnet carried by the car.

657,315. TELEPHONE SWITCHING APPARATUS; D. S. Hulfish, Chicago, Ill. App. filed April 12, 1900.

657,316. TELEPHONE TRUNK CIRCUIT; David S. Hulfish, Chicago, Ill.; Boston, Mass. App. filed May 25, 1900. (See page 419.)

657,330. ELECTRIC RAILWAY; T. P. Chandler, Philadelphia, Pa. App. filed July 27, 1900. An electric railway especially adapted for carrying light parcels, mail matter, etc. The car is suspended from one or more trucks having grooved wheels running upon an electric cable or conductor.

657,338. CENTRAL BATTERY TELEPHONE SYSTEM; W. W. Dean, Chicago, Ill. App. filed April 28, 1899. (See page 418.)

657,339. PLUG AND SOCKET FOR TELEPHONE SYSTEM; W. W. Dean, Chicago, Ill. App. filed April 28, 1899. Structural details for a socket or spring-jack switch.

657,342. TROLLEY CATCHER; F. J. Fairchild, Wyandotte, Mich. App. filed Oct. 21, 1899. A spring trolley-cord winder, attached to the car, is arranged so as to take up the slack of the trolley cord and prevent sudden rising of the trolley pole when the wheel leaves the wire.

657,359. THERMOSTAT; H. E. Reeve, New York, N. Y. App. filed Nov. 15, 1899. The elements of the thermostat are all carried by and beneath a protected shell or casing which is adapted to be secured to the ceiling.

657,375. LEAD WIRE FOR BLASTING; W. H. Williams, Concord, N. H. App. filed July 5, 1900. The wires are arranged in sections upon a winding drum, and may be connected with a source of electricity at any stage of their unwinding.

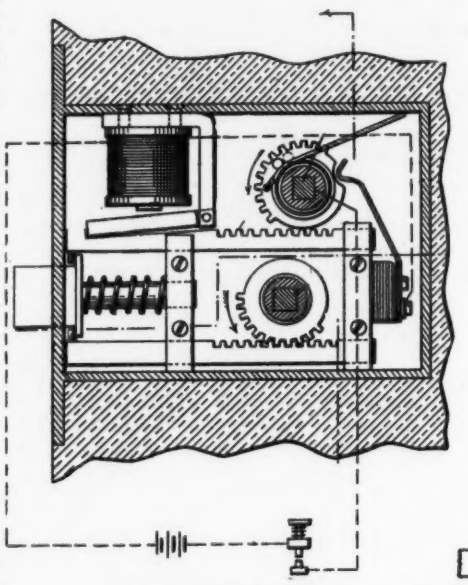
657,378. ROENTGEN RAY APPARATUS; Wm. S. Andrews, Schenectady, N. Y. App. filed Jan. 20, 1898. Maintaining a vacuum tube at a predetermined vacuum by passing current through the tube and taking a discharge from a point in the circuit to a condenser, etc., so as to vary the discharge in accordance with the vacuum in the tube. Other details.

657,413. HANGER FOR BATTERY ELEMENTS; J. L. Hayes, Salida, Colo. App. filed April 30, 1900. The hanger is formed of two pieces of wire twisted together to form a central eye, in which the carbon element is clamped, and divergent ends which rest upon the edges of the battery jar.

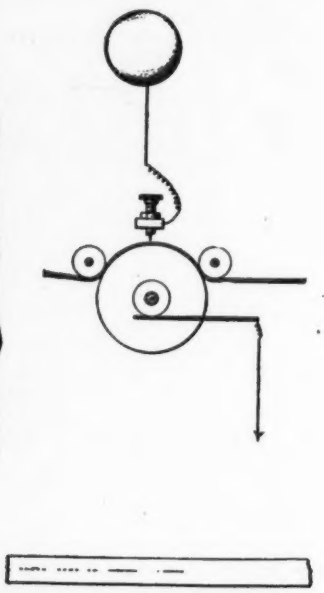
657,414. FUSE; R. Hundhausen, Wilmersdorf, Germany. App. filed Nov. 18, 1899. A spring or other tension device is used to separate the terminals of a fuse immediately after a rupture has taken place.

657,416. SPEED CONTROLLER FOR ELECTRICAL ELEVATOR; J. D. Ihlder, Yonkers, N. Y. App. filed Nov. 27, 1897. Details for producing a slow speed before brake is applied.

657,432. ELECTRIC ARC LAMP; J. Melzer, Cleveland, Ohio. App. filed



657,211.—Electric Lock.



657,222.—Wireless or Space Telegraphy.

April 2, 1900. This invention comprehends the use of a peculiarly constructed solenoid or magnet which permits the lamp to operate on circuits of high or low voltage.

657,433. ELECTRIC ARC LAMP; J. Melzer, Cleveland, Ohio. App. filed May 2, 1900. Details. (See preceding patent.)

657,450. ELECTRIC ARC LAMP; I. R. Prentiss, Lynn, Mass. App. filed July 15, 1899. A focusing arc lamp having a positive electrode fed by gravity, and a negative electrode relatively movable thereto, the latter being intermittently controlled by a derived circuit-coil which raises it at short intervals so as to maintain the arc at uniform level.

657,484. CLOSED CONDUIT ELECTRIC RAILWAY; L. Dion, Boston, Mass. App. filed March 6, 1899. (See patent 657,311, above.) In this case the energizing magnet is inclosed in a casing carried by the car.

657,485. ELECTRIC ARC LAMP; T. E. Drohan, Chicago, Ill. App. filed Aug. 26, 1899. A roller clutch is used for the upper carbon, the roller being carried upon a swinging arm and normally in binding engagement with the carbon. Electromagnetic means are employed for releasing the roller.

657,487. ELECTRIC RAILWAY SYSTEM; E. Frischmuth, Berlin, Germany. App. filed Feb. 12, 1900. Structural details which provide means for suspending the trolley wire by span wires which will not interfere with the free passage of the trolley wheel.

11,852. SYSTEM OF TRAIN CONTROLLER; E. W. Rice, Jr., Schenectady, N. Y. App. for reissue filed March 16, 1899. Provides means whereby motor cars equipped so as to run and be controlled independently may likewise be readily controlled from a single point when joined in a train.